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HOUSE OF COMMONS COMMITTEE.

Monday, May 14.

(Before Mr. D. R. Plunket, *Chairman; Mr.* Foljambe, *Mr.* Starkey, *and Mr.* Courtney.)

THE GASLIGHT AND COKE COMPANY BILL.

(*Continued from p.* 960.)

Mr. *Horatio Brothers*, examined by Mr. Michael.

I am the engineer of the western division of The Gaslight and Coke Company, and also a member of the Institution of Civil Engineers. I have had upwards of 30 years experience in the erection and management of gas-works. At the period of the amalgamation of the Equitable Company with the The Gaslight and Coke Company I was engineer of the former company, whose works were in Lupus Street, Pimlico. At those works we used oxide of iron for purifying our common gas. During the 12 years that I was the engineer of those works I do not remember any nuisance being complained of; in fact, I was complimented by the inspector upon the manner in which the works were conducted, and the freedom from smell. The works were in a densely populated and highly respectable neighbourhood, being situated just at the back of St. George's Square. The amalgamation of the Equitable with The Gaslight and Coke Company took place in 1871, and in 1873 we became subject to the restrictions that were imposed upon the latter company. Then I began to use lime moderately; but directly I began to use it in a larger quantity we had complaints from the surrounding neighbourhood, especially when the wind blew from the east or south-east over St. George's Square. In close, damp weather the complaints were more numerous. I do not believe in the theory of dust being carried from the purifiers, because I never found it so. On a wet day, no doubt, it would arise, and be carried, probably—the wind being in a higher quarter—over a greater distance; but St. George's Square is so very near, and the tops of the houses, I might almost say, abut upon the works. Complaints were made by authorities of the parishes of St. Margaret and St. James, and they sent their medical officer—Dr. Barnard Holt—to view the management of the station, and he made a report to the vestry. From previous experience I felt that the use of lime at Pimlico would result in a complaint of nuisance. Thirty-three years ago I used lime (before oxide was invented) at the Salford Corporation Gas-Works. They used it solely there, and in 1858 the nuisance became so great from the large quantity of gas being made, owing to the increase of the population, that, hearing the oxide purification was in vogue in London, the Gas Committee sent me up to make inquiries, and after those inquiries we came to the conclusion to use oxide instead of lime for the sulphur. I feel that, after all the care I have taken at Pimlico, it is impossible to avoid a nuisance if the use of lime is to be continued. In 1872, upon the amalgamation of the Western Gas Company with The Gaslight and Coke Company, I was appointed engineer at the company's station at Kensal Green, which was in such a dilapidated condition as not to be able to comply with the requirements of the Referees, and some time was allowed in order to reconstruct the works, and to put up better purifying apparatus. I have carried out the instructions of the Referees, and have been generally able to keep down the quantity of sulphur, although occasions have arisen where I have been unable, as there always will be. The Pimlico station is in a very low part of London, abutting on the river, in a very densely populated neighbourhood, inhabited by highly respectable persons. The Kensal Green station is in the country, with a population around it of the labouring class, and the purifiers are a long way remote from the habitations; the smell is, therefore, not very perceptible, because the houses are so far off. Living on the works myself, when the wind is in the direction from the purifiers to my house, I smell it very badly. We have about 6000 yards of refuse lime every year to get rid of, and we are now completely stopped in the disposal of it. I have advertised in all the local papers down the line on the Great Western Railway, and I have offered to put it in barges and trucks free of expense, and yet I cannot sell a single load. I do not see how it is possible to be continued to a very much larger extent, for I have in my place between 10 and 12 feet in depth of refuse lime. I do not know of any other mode of getting rid of the sulphur compounds but by the use of lime. I have never known of an instance where lime has been used as a purifying medium without its creating a nuisance; but where it is on a small scale, of course, the nuisance is not so great as it is on a vast scale, like we have it in London.

Cross-examined by Sir E. Beckett: I do not propose to get rid of the nuisance of lime altogether, but simply to use it for taking out the carbonic acid. The lime would be innocuous then, and there would be a very small quantity compared with what we now have—I should think somewhere about one-third. It would be of some value upon heavy lands in farming, and I should be better able to sell it or give it away, because it would be free from smell. The difficulty now is that persons will not take it, because of the smell arising from the use of it.

Mr. Richards said the letter of the Referees had produced a painful impression upon the minds of the company's engineers, because it seemed to have reflected upon their conduct, and they were rather anxious to repudiate anything of the sort. They were all present for examination if the committee wished it.

The Chairman: Do you think it will advance your case much?

Mr. Richards said he did not think it would, although it would satisfy the committee that each one of them had made an honest *bonâ fide* effort to carry out the directions of the Referees to the very best of his power; to effect purification by lime without causing a nuisance and yet had failed to do so. There was no ground for suggesting that they had ever been trying how not to do it.

Sir E. Beckett said it would not be the business of the Referees to give directions. The only mistake which the Referees had made, in his opinion, had been in yielding to the companies. It would have been much better to have said to the engineers, "It is not our business to say how the manufacture of gas is to be conducted; if you do not do it in a proper manner we shall judge for ourselves, and give the required certificate accordingly."

Mr. Round said that, on the part of the Referees, he did not impute anything to the engineers of the company. They had to deal with the uniformity or the want of uniformity in the system which those gentlemen individually had to carry out, and they never in any way desired either to say, or to wish it to be inferred in the slightest degree, that there was anything derogatory to them or to their individual ability, but to the system as it had been carried out by them, doubtless in obedience to orders.

After some conversation, during the course of which the letter of the Referees, dated April 20, 1877, was again read,

Mr. Richards expressed himself satisfied that there was not any imputation cast upon the engineers.

Mr. *George Carless Trewby*, examined by Mr. Richards.

I am the engineer at the Beckton station, and also a member of the Institution of Civil Engineers. I have been engaged in the manufacture of gas for a quarter of a century. The Beckton works are by far the largest in the world. The site there has been made up to a very great extent with spent lime, partly derived from the operations on the works, and also from lime brought from other places. During the last twelve months we have covered something like 10 acres. The other stations have no other place to deposit it but Beckton. Taking the average for the last twelve months, the depth has been from 6 to 9 feet, spread over 10 acres. If the present system of lime purification is continued at Beckton, and if we have to find space for the refuse lime, and the gas supply goes on increasing, the quantity to be deposited at Beckton will be upwards of 100,000 cubic yards per annum; and when we extend our buildings we shall have to excavate it, and remove it elsewhere.

Mr. Richards: Will not danger arise from so large a deposit fouling the watercourses?

Witness: Yes; We have had an action already commenced against us for fouling a watercourse. It is almost impossible to prevent percolation.

Have you found the difficulty of getting farmers and other persons to take away the refuse lime?—Yes; there is a very limited demand for it.

In point of fact, the only place where the company can deposit it at present is the Beckton works?—That is so. I have heard the evidence given as to the nuisance created by this lime, and I endorse every word of it. By the old process of peroxide of iron, a certain quantity of lime was used to take out carbonic acid, but no nuisance was caused. I have worked both systems.

Cross-examined by Sir E. Beckett: The refuse lime has been accumulating ever since the Beckton works were started, five or six years ago. In 1875 the filling in of the lime simply kept pace with the increase of the works, but the amalgamation with the Imperial Company had not then taken place.

Sir E. Beckett: Did you suggest to anybody in 1875 the expediency of getting rid of this accumulation?

Witness: We were in hopes, if we addressed a proper representation to the Referees upon the matter, that they would give us relief.

Then you complain personally of the action of the Referees, and not of the system? Is that so?—Well, I take the two things combined together.

But is it the two things combined together? You say that you were in hopes, in 1875, that a proper representation to the Referees would give you relief?—In 1875 the question of the accumulation of lime had not presented itself to our mind.

Of course I cannot investigate your mind, but the fact is that the lime was increasing at a known rate, was it not?—Just so.

Well, the lime increasing at a known rate, and you, being before the committee, and discussing the work as an engineer, did not think of asking the committee to set you free from that obligation?—I believe not.

When you talk about the Referees, you knew that the Referees had been in existence before then?—Yes.

Then what it is you are really complaining of now I do not understand?—As far as I am concerned, I am complaining of the amount of refuse lime that is brought down to my station, and also of the nuisance, because it not only affects my health, but it affects the health of the persons who are bound to live upon the works. On a day like this, from inhaling the sulphuretted hydrogen and the sulphur compounds over the whole area of our works, it causes depression of spirits.

Re-examined by Mr. Richards: The amalgamation with the Imperial Company took place in 1876, and it is since some of these stations have been added to The Gaslight and Coke Company that the evil has become much more conspicuous.

By the Committee: As things are going on at present, I think our spare ground will be filled up with the spent lime in less than three years.

By Mr. Round: The land at Beckton is about 6 or 7 feet below the level of high-water mark, and we have been utilizing this lime hitherto for the purpose of raising the level of our land.

Mr. Round: I do not wish to underrate the inconvenience you have alluded to, but could you not go on for the next two or three years and rather benefit your property?

Witness: No, because if we extended our works we should have to excavate into the deposit. We are already doing that, and the nuisance to the men is something more than can be imagined.

Do you mean you are already excavating lime that you have in the last two or three years deposited?—Yes.

And you are not depositing in order to raise your land up to the level of

high-water mark?—We are depositing it because we have no other place to put it in. For no other purpose.

But there must be many parts of your property at Beckton which it would be desirable to raise to a higher level than they are at present, are there not?—No, it is already done.

Dr. *Thomas Stevenson*, examined by Mr. MICHAEL.

I have been Medical Officer of Health for St. Pancras for nearly nine years. In the autumn of 1875 it was brought to my knowledge, by the inspector of nuisances and others, that there had been complaints going on for some time with regard to the nuisance arising from the gas-works at King's Cross. The complaints were serious, and in the month of December I called on Mr. Chubb, and I went on the same day to the works; I also visited them several times subsequently. I found a great stench arising from the works, and I learnt from Mr. Chubb that it arose from the fact that they were obliged to use lime in the purification of the gas. I was well aware of that fact, so I made myself thoroughly acquainted with the works. I saw the lime purifiers opened, and there was a very powerful odour during the operation. The odour of sulphuretted hydrogen and ammonia was very strong near the purifier, and I could detect sulphuretted hydrogen outside the works, in the neighbouring streets; but upon investigating more I found that the nuisance extended to a very considerable distance—even to Argyle Square, which is 600 yards south of the works, where no sulphuretted hydrogen could be detected. I say that undoubtedly there is something besides, or in addition to, the sulphuretted hydrogen causing the nuisance, for when the nuisance has been at the worst, you could detect, by various means, sulphuretted hydrogen on and about the works; but, after going a certain distance from the works, you could not detect any sulphuretted hydrogen, and then the peculiar odour of this gas lime—this sulphate of calcium—came out. I cannot say that a smell of such a kind is injurious to health, neither can I obtain any distinct evidence of it, but it is a very disgusting, disagreeable smell, and very annoying. A small quantity of sulphuretted hydrogen will produce powerful effects. There are various experiments recorded where, if it exists to the extent of one per cent., death is the result. I have had cases within my own experience where great danger to life has ensued from inhaling sulphuretted hydrogen. That occurs when it is liberated in any way, especially from chemical causes. I asked the authorities of the then Imperial Company to carry out certain steps which I thought would modify, or, in a great measure, abate the nuisance. Those were ventilation of the purifiers before employing them, if possible, by the passage of carbonic acid through them, with the subsequent passage of the air which is drawn through the purifiers, through oxide of iron, or a furnace, in order to get rid of the foul gas from the purifiers; practically the mode, such as has been described and illustrated upon this model. My proposals were not carried out on those works. Plant was put upon the works to do so, but in consequence of what I heard as to the effect of the process at other works, I did not insist upon my proposals being carried out. I went down to Bromley, and saw the effect; there had been great heating of the purifiers, by which they had been materially damaged. I was also shown certain apparatus, which I was told had exploded through carrying out this system of purification, and was told by Mr. Wright, the engineer, that the rubbish arising from carrying out the process was so great that the cure was worse than the disease. I do not think that any such quantity of sulphur as would be left in the gas, after careful oxide of iron purification, would result in injury. I work in a laboratory where gas, purified by the old oxide process, is used. I tested the gas almost continuously during the months of February and March last, and I found, on an average, 38 grains of sulphur per 100 feet. I have not found any injurious effects to my health from the use of such gas. I do not think, if the amount of sulphur does not exceed 40 grains, it would cause any likely amount of injury. I have made a series of experiments, by which I am enabled to give that evidence, the results of some of which have been already given on the previous Bill.

Cross-examined by Sir E. BECKETT: If there is not free ventilation, even 15 grains might cause a considerable amount of damage and discomfort, but I do not think the difference between 15 grains and 35 grains would require any material increase in ventilation, because the sulphur would be so small in effect.

Sir E. BECKETT: Then you think that the company might safely be left to the 40 grains, do you?

Witness: I think that 40 grains would exercise no prejudicial effect.

Then I am afraid this committee must have made a great mistake upon the other Bill?—That is not for me to express an opinion upon.

The COMMITTEE: You do not deny that there is some difference in the inconvenience and the nuisance between 20 grains and 40 grains?

Witness: I have not been able to perceive any appreciable difference in burning the two gases.

That is a question of ventilation, but you will not deny that, under the same conditions as to ventilation, there would be a considerable difference?—I deny that there would be a considerable difference. I found in my experiments about 5 per cent. of the sulphur was converted into sulphuric acid, but the difference between 5 per cent. on the 15 and 30 grains, I think, would not be material.

Do you mean to say, supposing you burnt gas with 15 or 20 grains, under the same conditions that you burnt gas containing 40 grains, that there would be no difference?—There would be a difference, but it would be so small, I think, that the effect upon health and upon the destruction of furniture, and so on, would not be appreciable, and I do not think the difference could be weighed against the nuisance arising from the lime method of purification.

By Mr. ROUND: I did not communicate any of these complaints to the Referees; I have acted for my own Sanitary Committee, and I have nothing to do with the Referees.

TUESDAY, MAY 15.

M. *Felix Le Blanc*, examined by Mr. RICHARDS.

(Mr. ALBERT sworn as Interpreter.)

I am a Chevalier of the Legion of Honour, Professor of Analytical Chemistry to the Central School of Arts and Manufactures in France, a Member of the Council of the Society for the Encouragement of National Industry, and have been engineer-in-chief for the verification of the gas supplied to the Municipality of Paris since 1863. I know all the conditions arranged in the treaty made between the Municipality of Paris and the Paris Gas Company. Those conditions were drawn up between M. Dumas on the part of the town, and M. Regnault on the part of the company. My duty is to see that those conditions, so far as they relate to the testing and verification of the gas, are obeyed and carried out under Article II. The reports are made 24 times a month, at 11 offices, corresponding to the seven gas-stations in the City of Paris, and I produce the report of one day's experience at all the stations. The Paris Gas Company have not only fulfilled all the obligations imposed upon them by the treaty, but in many instances they went beyond those conditions, by supplying a better gas than they were obliged to do. The following are the requirements as to purity:—"The efficient purity of the gas shall be stated or proved by bands of white paper not starched, which have been previously prepared by dipping the same into a solution of neutral acetate of lead, in distilled water, containing one of salt per hundred of water. These strips of paper shall remain in a current of gas during the duration of one of the relative trials or tests of the illuminating power—that means to say, one quarter of an hour—and if they shall not get brown the purity is perfect. This test, anyhow, shall be made in conformity with the prescribed instructions of MM. Dumas and Regnault." The paper must not even get yellow; that is the only condition as to purity. I can state, from my own knowledge, that before the treaty was concluded there were continuous complaints, but at the present time those complaints have ceased to be preferred, and for several years none have been made. It is very seldom indeed that the examiner finds any discoloration of the paper, which otherwise would be the subject of a fine. The gas is purified with oxide of iron, which is generally prepared with sulphide of iron and lime; and a current of water and air is carried through. It is well understood that the deposit of tar and ammonia is found in the purifying-boxes; however, no conditions as to that are imposed upon the company. The company have never used lime alone in Paris. I believe that the company find it to be to their interest to employ oxide of iron, because not only the sulphur, but the sulphuretted hydrogen, is entirely absorbed by it, and also because there is economy in it, as the purifying material, when they have been used for some time and get black, are put upon trays. Then there comes the revivifying process, when that iron with the sulphur is oxidized and can be used again.

Mr. RICHARDS: Do you think the use of lime would prove a nuisance in the City of Paris?

Witness: I am not a medical man; but in London, when I went to Beckton, to where the purifying-boxes were open, I found a smell which was very disagreeable. In Paris I found that the purifying material gave off a smell, certainly, but it was more an ammoniacal smell, and not such a fœtid smell as in London; and the medical men over there constantly apply to the company to allow invalids, and people who suffer from cough or whooping-cough, to inhale those vapours, but I will not guarantee the efficiency of that. I have never found any smell of sulphur in rooms in which gas is burnt in Paris. I must, however, state that there is a very slight acidity in the products of combustion; there is a small amount of ammonia, but the treaty does not prohibit that. In the combustion there may also be formed a small quantity of sulphurous acid, but so small, indeed, that nobody takes the slightest notice of it, and it never gives rise to any complaints from the consumers. There are only a few libraries in Paris, to which readers are admitted, where gas is burnt in the evening, and the librarians do not make any complaint. If there were any complaints, they would be made to the Prefect of the Seine, who would send them to his engineers. Another remedy is that a suit can be instituted against the gas company. I know the celebrated shop of MM. Christophel, who are silversmiths, and do silvering and gilding. Before the treaty which was entered into between the company and the City of Paris they thought it to their advantage to make their own gas. Their purpose was to have gas entirely free from sulphur, and that gas was made by decomposition of water by charcoal. Since the treaty they have given up making their own gas, but they have never complained either to the company, to the town, or to the engineers. It is quite evident, in case the gas contained sulphur, that it would, the moment they opened the tap, have an effect upon the silvering process. I beg to say, also, that the purpose or object of the commission, by which the treaty resulting from it was made, was that a certain quantity of ammonia should be allowed in the gas.

In the discussion before the treaty was made, was the question of the presence of sulphur compounds, other than sulphuretted hydrogen, discussed at all?—Although nothing appears upon that point in the treaty, still I will tell you what occurred from what I have heard stated by M. Dumas.

Can you tell us of your own knowledge anything which took place with reference to the discussion upon the sulphur compounds?—There is a certain quantity of ammonia which is allowed to exist favourable to the purification of the sulphurous compounds, and I will tell the reason. Sulphide of carbon, for instance, in the presence of ammonia, is much better kept or held in the purifying-boxes. Chemists know that the sulphide of carbon acting upon the ammonia can easily produce sulpho-cyanide of ammonia; therefore this is a system to prevent the sulphide of carbon mixing up with the gas. Sulpho-cyanide has for some time been employed for photography, and the man who buys from the company the old material from the purifying-boxes extracts that sulpho-cyanide of ammonia for sale as a matter of business. After a great number of these purifying processes have taken place, then it is sold to M. Conchatt.

Mr. RICHARDS said a report had been sent by M. Dumas, which he proposed to lay before the committee, and, after a short discussion, it was read, as follows:—

Institute of France, Academy of Sciences,
Paris, May 1, 1877.

Mr. President,—Lord Lyons having informed me of the desire of the Government of Her Majesty the Queen to know my opinion upon the gas question, I have the honour to send it to you, and to beg you to communicate the same to the committee charged with the Bill of The Gaslight and Coke Company.

Accept, Mr. President, the assurance of my respectful sentiments,

J. B. DUMAS, the Perpetual Secretary of the Academy.

Opinion of Monsieur J. B. Dumas, late Minister of Agriculture and of Commerce, Great Cross of the Legion of Honour, Perpetual Secretary of the Academy of Sciences, Vice-President of the Superior Council of Public Instruction.

I was one of the Municipal Council of the City of Paris during sixteen years, and I have had the honour to preside over it during more than ten years.

In this capacity I have often had to occupy myself with questions relating to the manufacture of gas for lighting purposes, to the verification of its practical qualities, and to the consequences of its use.

I have been especially called upon to prepare the treaty which has regulated for sixteen years the interests of the Parisian Gas Company and those of the City of Paris, and to determine the obligations to be imposed upon the company, and the means to ensure their exact performance of them.

Before the treaty was interposed the situation was intolerable.

In consequence of errors committed, the exigencies relative to the appreciation of the illuminating power, and of the absence of control relative to its practical purity, it happened—

1. That every day the company were condemned to 1000 francs fine for insufficiency of illuminating power.

2. That every week the Municipal Council received complaints from the consumers, which denounced the gas as having [blackened or darkened plate or brass in the silversmiths shops, or the steel or iron goods, or the plates and dishes, or the crystals in the glass and china shops, and the white lead painting in apartments, as having discoloured or faded the shades of stuffs in the silk shops, as having inconvenienced or made ill the actors or the singers in the *cafés chantants* and the theatres in which the footlights were lighted with gas, the first of these effects being attributable to the sulphuretted hydrogen, and the second to the sulphurous acid produced by its combustion.

In order to end all these disorders, I have asked that a complete verification of the illuminating power of the gas should be effected, and that measures should be instituted in order to ensure its practical purity in a permanent manner.

It is not now the time to explain how these trials, which took more than a year, were conducted and were carried out in a little experimental works for the preparation of the gas, as well as at my laboratory at the Sorbonne, for the verification of its illuminating power and its purity. It will be sufficient to state that the system adopted by the Municipal Administration upon my report having been in operation since the year 1861 did not give rise to any criticism; it notably caused the disappearance of all complaints relative to the insufficiency of the illuminating power, the presence of sulphuretted hydrogen, and of the production of sulphuric acid.

The examiners of the illuminating power only found the gas once, by accident, below its limit; the jewellers and steel and metal dealers, the crystal and crockery merchants, and private individuals having painted panellings in white lead, the magazines of embroidery or of *nouveautés*, the artists of the theatres, never came to complain of the damage or inconvenience which the old gas made them experience.

Therefore it seems certain that, taking simply the practical point of view of the matter, the harmony between the company producing the gas, the authorities which watched over its good quality, and the consumers who used it, seemed to be solidly established; nobody makes complaints.

I leave on one side the economical and financial question, which, however, is full of interest, but which does not touch the sanitary side of the question, nor the control of the fabrication. I restrict myself to state that which concerns this latter aspect of the question.

There were present on the one side the company charged to manufacture the gas, and on the other side the City of Paris, the latter intervening under various titles—

1. As proprietors, possessing the soil in which the company established their canalization.
2. As customers, consuming the necessary gas for the lighting of the streets.
3. As partners, taking part of the profits of the company.
4. As the Municipality, charged to watch, in the public interests, over the strict execution of the clauses of the contract incumbent upon the company.

In order to simplify this situation, and to avoid all interpretations of a nature to be inconvenient to the contracting parties in their respective movements, it seemed to me to be necessary on the one part to leave to the company the most complete liberty for its means of production, and its procedure for purification; on the other part to constitute a sort of tribunal, charged to state legally the purity of the gas which has been distributed for consumption, just as one states the title of moneys put into circulation.

In consequence it was agreed that M. Regnault, representing the company, and I, representing the City of Paris, should establish, in concert, a system of control, and prepare apparatus to realize this system, the company and the city accepting in advance our mutual results.

In the name of the city, I considered it indispensable to guarantee—

1. A very definite illuminating power.
2. The absence of sulphuretted hydrogen.

I only state, as a passing remark, that the procedure which we proposed in order to control the illuminating power is adopted to-day in a very great number of towns in France and abroad, and that there has been constructed at least 157 apparatus of verification for the purpose.

As to the absence of sulphuretted hydrogen, we thought that the inconvenience of its presence having been rendered sensible by its action upon the compounds of lead, it was sufficient to exact that the gas should remain without appreciable action on paper impregnated with a salt of lead during an exposure of a quarter of an hour.

The question was discussed between M. Regnault and myself, in order to know if it was right or not to exact that the gas should be free from ammonia, and that it should not have any alkaline reaction. Our opinion was that the pressure of some traces of ammoniacal gas was not inconvenient at all for the consumer, that it would ensure the disappearance of the sulphide of carbon entirely or nearly so, and that in consequence it avoided the formation of sulphurous acid at the moment when the gas was burning. As to fearing the presence of an excess of ammonia, there was no occasion to trouble about it, its price engaging the company to gather it out.

Thus we were led to establish that the gas supplied by the company should be coal gas endued with a definite illuminating power, and without action upon the acetate of lead paper. We knew that the gas was alkaline.

For all the rest the company are free to produce their gas just as they think proper, and to purify it in a manner conformed to their interests, or to do it at their convenience, the town reserving to itself only the right of observation, like a partner, in case, by the use of onerous or badly conceived processes, one should happen to bring trouble into its finances, or compromise the profits of the operation. By the wise direction of the company, every remark on that subject, on the part of the engineers of the city, has become useless.

Conformably with these principles, M. Regnault and I have instituted a series of various and prolonged experiments, which are resumed in the practical instructions for the use of the examiners charged with the daily verification of the gas delivered to the public.

These practical instructions have been accepted by the two contracting parties, and have been incorporated in Article II. of the treaty before mentioned, page 11 of the edition of 1871, lines 12 to 20 inclusive, and have been annexed to this treaty, in which they will be found on pages 23 and following.

The stipulations relative to the purity and illuminating power of the gas delivered to the public are found in Article II. of the treaty, page 7, edition of 1871.

This article provides that the gas shall be extracted from coal, that it shall be perfectly purified, that its illuminating power shall be that of a burner consuming 105 litres of gas, giving a light equal to that of a Carcel lamp consuming 42 grammes of purified colza oil.

The experiments established by means of this report embraced the production of gas from all varieties of coal, from whatever source the company could obtain them to ensure their service—French, Belgian, English, and German; for the burner, all varieties of burners known.

M. Regnault and I were constantly assisted, during the long and troublesome work, by two distinguished chemists, M. Paul Audouin, engineer of the gas company, and M. Paul Bérard, secretary of the Consulting Committee of Arts and Manufactures attached to the Ministry of Commerce, who were authorized by us to publish the details.

From these numerous and varied experiments, we have deduced two principles on that which concerns the verification of the illuminating power. The first is, that the gas-burner ought to approach as much as possible in form and flame to that of the Carcel lamp taken for a type—conditions which were found realized in a porcelain burner of the Bengel system.

Second, that the photometric apparatus should be so arranged that the examiner would have only the variable point to determine, all others remaining constant in each trial.

The Carcel lamp and the gas burned which have to be compared having been lighted, the examiner assures himself that the lights have the same intensity, being placed at the same distance from the photometric disc. This equality being established and maintained, the gas-meter is placed at zero, while the Carcel lamp, placed upon the plate of the balance, is kept in equilibrium by a weight of 10 grammes. When it has burned 10 grammes of oil this equilibrium is broken, a bell informs the examiner, who stops the pointer, and who has only to read the figure indicated by the meter to ascertain the consumption. He notes how many litres of gas have been burned in order to produce a light equal to that which 10 grammes of purified colza oil supplied, and, therefore, how much it requires to correspond with the consumption of 42 grammes of oil per hour.

In order to ascertain the state of purity of the gas, we have had recourse, as has been already seen, to the employment of a band of unstarched paper dipped in a solution of acetate of lead, formed of one of salt for 100 of distilled water, suspended in a tubulated bell-glass placed upon a tray. The cock which communicates the current of gas to the bell-glass is opened, the gas passes into this bell-glass, and circulates there under a pressure of from 2 to 3 millimètres of water during 14 or 15 minutes—*i.e.*, during the time necessary for an experiment to ascertain the illuminating power. After having passed through the bell-glass the gas is burnt.

If after this period of time the paper band has remained white, the gas is considered exempt from all sulphurous impurity of a nature to be injurious to the public—practically it is considered to be purified gas.

Every contravention concerning the presence of sulphuretted hydrogen is the subject of a *procès verbal* followed by a fine.

When the illuminating power is regularly obtained, the obligations of the company towards the city and the public are regarded as having been satisfied. In a contrary case, and after a certain number of re-occurrences, the company are exposed to the prescribed penalties, which not being any longer excessive, as they were before, would be applied with rigour. But their intervention has not been found to be necessary but once in what concerns the minimum of the illuminating power, and one might have believed that in the long run the verification of the gas was useless, because there were so few contraventions.

It cannot, however, be doubted that this verification is indispensable; it has precisely for consequence the prevention of all relaxation in the important service of the lighting of Paris; it has contributed in the highest degree to maintain the company in the excellent line of conduct which they have adopted from the commencement, and have persevered in hitherto.

During more than ten years as President of the Municipal Council, it was my duty to state officially the results obtained by the application of these measures taken altogether. Since I have ceased to fulfil these duties in 1870, I have been enabled, by official communications, to keep myself informed of everything which is of interest in a service, at the creation of which I had taken so important a part, that it was not possible for me to lose all interest in it. I have, therefore, the right to affirm that the treaty, in the preparation of which my public duties and my special studies had furnished me with the occasion to participate, under various titles, and had the happy fortune to consecrate the liberty of action of the company to supply each year an important contribution to the finances of the city, to guarantee in all points of view the public interest, to increase the proportions of light placed at the service of the public ways, to decrease the price of gas, and to make disappear all appreciable damage to the consumer.

(Mr. Albert verified the copy handed in as being a true translation of the original.)

Cross-examined by Mr. Cripps: The paper bands dipped into a lead solution are used for the purpose of ascertaining whether the gas is free both from sulphuretted hydrogen and from ammonia. The only difference between the French and the English systems is that the paper is saturated with moisture in order to absorb more upon the paper, to make the paper more sensitive to it.

Mr. Cripps: But all that difference between the English and the French systems is still only directed to the test for sulphuretted hydrogen?

Witness: For all materials which attack or make an impression upon the lead solution.

Have you made any experiments to determine the quantity of sulphur compounds in 100 feet of coal gas in Paris?—No; such an experiment I should consider a weak one.

You know nothing at all of the quantity of sulphur compounds contained in the Paris coal?—I do not study that question; my duties are simply to see that the conditions stipulated for in the treaty are strictly observed.

So long as the conditions of that treaty are performed, you have nothing further to do with the matter at all?—I have other duties to perform, certainly, but nothing more as to the purifying process.

The Chairman: I am certainly rather fresh in chemical combinations, and I am not sure whether I follow the evidence. Am I right in thinking that in Paris they are allowed a certain amount of ammonia in their gas, with a view to neutralizing the effect of the sulphur compounds—is that so?

Mr. Michael: What he absolutely said was this: We do not so much care about taking out the whole of the ammonia, because, retaining a small amount of ammonia in the manufacturing process would not prevent the fixture of a certain quantity of sulphide of carbon in the process of purification. (To witness:) Is there any limit to the ammonia allowed in the gas in Paris?

Witness: That is not expressed in the treaty, but I can state that I have discovered, in my examinations, it was about the tenth part of a milligramme per litre, which is the same thing as a decigramme to a cubic mètre; there are 1000 litres in a cubic mètre.

The Chairman: That is 5 grains in 100 cubic feet?

Mr. Keates: About 4½ grains.

Mr. Michael: One grain and a half in 35 cubic feet.

The Chairman: All you are allowed in London is 1½ grain.

Mr. Richards: At the present moment it is 2½ grains.

The Chairman: Then it is nearly twice as much in Paris.

Mr. Richards: If only half the quantity of ammonia which is in the Paris gas were to be allowed in that gas, would it have any effect upon the sulphur compounds?

Witness: My own opinion, and also that of M. Dumas, is, that the presence of ammonia has an effect, which is to retain the sulphur compounds, or, perhaps, the other sulphurous compounds, or matters not well known. We are not under any fear that the company would give a supply of gas so much impregnated with ammonia, because it is a source of profit to them to retain, or to separate as much as possible, the ammonia, which is a source of profit to them.

By the Committee: There are two things to be considered—first of all, whether the ammonia should be in sufficient quantities to prevent the acidity of the gas before it is lighted. When the lighting takes place, then the ammonia itself is decomposed, and, even if there could result from it, a trace of nitric acid; and for this reason it would be inconvenient to increase the quantity of ammonia.

Mr. Michael: The witness has not stated whether the presence of ammonia has any influence in preventing any of the bad influences when sulphur is present during the combustion.

The Chairman: I will put the question in this way. It has been proved to us, or we have had evidence, that in the combustion of the London gas, the sulphur compounds produce sulphuric acid, and this sulphuric acid has an injurious effect upon furniture, gilding, and the binding of books. Supposing that is so, do you think that the presence of the amount of ammonia allowed in the Paris gas would prevent that, or neutralize it in any way?

Witness: No; the ammonia disappears in the combustion, and cannot afterwards give any alkaline produce. The presence of ammonia has been considered useful in the passage of gas through the purifiers to retain the sulphurous compounds, which otherwise would escape. I think that the English chemists who are interested in this question have occupied their minds a great deal with the sulphuric acid question consequent upon combustion. I think there is something very much more pernicious, or hurtful, or injurious, and that is the presence of a very small quantity of sulphuretted hydrogen in the gas; and this is the reason why we keep strictly to an absolute purifying process.

Mr. Cripps: I asked the witness whether he had made any experiments by which he could determine how many grains of sulphur compounds there would be in the Paris coal in 100 feet of gas. He said that he had not made any experiments, but I am told that I did not make it quite clear; and I want to know whether he knows that matter from his own experiments or from any other source?

Mr. Michael: We are going to call Mr. Ellissen.

The Chairman: In the report, he refers to the stipulation in the English private Act forbidding more than 20 grains, so that he is conscious of the thing.

Mr. Michael: When the gas is perfectly free by purification from sulphuretted hydrogen, do you attach any importance to the sulphur compounds, other than sulphuretted hydrogen, which may be in the gas when it is burnt?

Witness: It is evident, if there are notable quantities of these compounds in it, that the combustion, giving sulphurous acid—which oxidizes itself, to give afterwards sulphuric acid—must have some inconveniences; and on that subject there would be complaints in the shops where there are coloured stuffs, which would be affected by the sulphuric acid; and those complaints have not been made. I must observe, however, that I have not studied the London gas, nor the coal from which it is made. I know the French procedure of making gas, and I come to explain and to justify that which is done in Paris.

By the Committee: The Paris Gas Company buy coal of very different kinds. There is in connexion with the largest gas-works in Paris an experimental work where every quality of coal is examined, and also the products therefrom, and the different kinds of purification. The company know beforehand the kind of gas that will result, and, therefore, they care as little as possible to employ pyrites coal, which produces those sulphurous compounds.

As a matter of fact, the coal which is used for the production of this Paris gas is wholly free from the ingredient which makes the sulphurous compounds?—That would be impossible. I am not admitted to the management of the Parisian Company; but the control of what is supplied by them is in my hands, and as long as I see that the conditions of the

treaty are obeyed, then the manufacture of the gas, and the coal, or any ingredient, does not concern me at all.

You have said that there is an experimental work where they try the coal before they use it, in order to ascertain whether it is the kind of coal which would produce much sulphur. Can you suggest any reason why, after so trying them, they should select the coal which would produce the least sulphur?—Their interest is that the purification process should not be made too difficult.

Is the check upon the company using a very sulphurous coal that they would apprehend complaints being made of the sulphurous compound after it had been supplied to the consumers?—This consideration would be rather too limited. In the purchase of coal and other materials the company have different points in view.

What are those points of view?—The nature of the manufacture, the illuminating power of the gas, the accessory produce, the quality of the coke—in fact, everything which makes the manufacture advantageous with the materials given for it. However, of all this I am not a judge; but the engineers of the company are, who pronounce thereon.

M. *Albert Ellissen*, examined by Mr. MICHAEL.

I am a Chevalier of the Legion of Honour, and a chemical engineer. I was formerly engineer of the Paris Gaslight Company, and also chief of the experimental works, which were erected in the ordinary works at Villette, to ascertain the value of the coals, and to make certain experiments in the processes of the manufacture of gas. I am at present practising in Paris independently as a consulting gas engineer. I am also a director of the Madrid and some other gas companies. I was the chief engineer of the experimental works for about 10 years, and quitted the service of the Paris Gaslight Company in 1871. I am thoroughly well acquainted with the theory and practice of gas-making, as performed both in France and England, and also with the mode of purification adopted in both countries, I am also well acquainted with the treaty which was entered into between the City of Paris and the Paris Gas Company, referred to at length by the last witness. There is no other test adopted in Paris as to the other sulphur compounds in the gas after it is free from sulphuretted hydrogen.

Mr. MICHAEL: Have you yourself made any tests as to the quantity of sulphur remaining in the Paris gas after purification from sulphuretted hydrogen had been carried to its full extent?

Witness: I made some experiments in 1864. I was asked by the English companies to come over and make some experiments on the London gas, and when I when back to Paris I made some experiments, not on the Paris gas, but on a special gas at the experimental works. What I intended to do was, not to have the absolute quantity of sulphur, but only to see how the several products would act on the sulphur; so that it was not to make a test of the Paris gas, but only to make a test of a special gas made at these experimental works. The coals employed by the Paris Company are of all sorts—English, French, German, and Belgian. It is certain that Belgian coals are much more free from pyrites than the general English coal. Before the war, the Paris Gas Company used a great quantity of English coal—sometimes one-half—in their works. They have still contracts for English coals, and I think that they have now is for Pelaw Main and other coals which are used for gas manufacture in England.

Mr. MICHAEL: In the experimental works was it a point with you to ascertain specially the freedom from sulphur in the gas?

Witness: That was not at all my occupation, and the Paris Gas Company never did make experiments on this point. The only thing done at the experimental works was to know the value of the coal—which is one of the great points—to see what was the production of gas and coke, and then to see if the Paris gas corresponded to the products obtained.

As far as you know in Paris, has there ever been any question except freedom from sulphuretted hydrogen in the gas?—No; there has never been any other question.

Has there ever been any trouble from the presence of sulphur compounds in the gas, after the gas has been purified from sulphuretted hydrogen?—I never heard of any trouble.

Supposing that any bad effects had resulted from any sulphur compounds left in the gas after the purification from sulphuretted hydrogen, would you have been likely, as the engineer of the gas company, at once to have heard of such complaints?—The directors of the company would have sent to the experimental works to make experiments about it; but no such experiments were made.

Have you ever yourself seen any bad effect resulting from the use of the Paris gas, owing to sulphur compounds other than sulphuretted hydrogen?—I have never seen any effects. I know all the places in Paris, and I never heard of any bad effects.

Examination continued: The quantity of gas used in the Paris shops is so immense, and also where the pictures are, and the Opera House, and so on, that there would be a complaint if there were any compounds from sulphuric or sulphurous acid deposited. In the Louvre they burn something like 70,000 cubic mètres in a night, and Beaumarchais about the same quantity. There is no test at all in Madrid, nor, as far as I know, in any town on the Continent, except the one that is in use at Paris, for sulphuretted hydrogen. I know all the contracts made between the towns and the companies, and, excepting England, there is not one stipulation about sulphur compounds other than sulphuretted hydrogen. In Madrid they use a great part of English coals; in Italy they use English coals—there are sometimes stipulations made about that—and the last treaty of Bordeaux, made this year, does not contain any stipulation of that sort. Oxide of iron is the only thing which has been employed in Paris for some 20 years to get rid of sulphuretted hydrogen. Lime was previously used to take out all the sulphur of the gas; but since oxide of iron has been known in the manufacture of gas, all the gas-works that I am aware of use only oxide of iron. I have seen the works at Pimlico, at Shoreditch, and at Beckton, and I am sure they would not in Paris allow working lime on that scale; it would immediately be stopped by the Prefect of Police. I have here some tables of experiments I made with respect to the quantity of sulphur in gas.

The following tables were delivered in:—

Hornu (Belgium) Coal, containing 15·05 lbs. of Sulphur per Ton distilled at a Low Temperature.

Length of Time of Distillation.	Yield of Gas per Ton of Coal.	Rate at which the Gas was consumed.	Sulphur in 100 Feet.
6 hours. . .	8,610 feet. . .	1·010 feet. . .	6·07 grains.
6 „ . .	8,610 „ . .	1·010 „ . .	6·28 „
6 „ . .	8,300 „ . .	9·734 „ . .	6·29 „
6 „ . .	8,300 „ . .	0·734 „ . .	6·54 „
7 „ . .	7,800 „ . .	0·819 „ . .	5·91 „
7 „ . .	7,800 „ . .	0·819 „ . .	6·10 „
7 „ . .	7,200 „ . .	0·833 „ . .	7·65 „
7 „ . .	7,200 „ . .	1·416 „ . .	2·762 „
7 „ . .	7,820 „ . .	0·988 „ . .	5·567 „
7 „ . .	8,190 „ . .	0·865 „ . .	6·247 „
7 „ . .	7,920 „ . .	0·812 „ . .	4·675 „

Denain (French) Coal, containing 31·10 lbs. of Sulphur per Ton, distilled at a Low Temperature.

Length of Time of Distillation.	Yield of Gas per Ton of Coal.	Rate at which the Gas was consumed.	Sulphur in 100 Feet.
7 hours. . .	8,610 feet. . .	0·688 feet. . .	5·227 grains.
7 „ . .	8,610 „ . .	0·589 „ . .	4·037 „
6 „ . .	8,290 „ . .	0·861 „ . .	1·742 „
6 „ . .	8,030 „ . .	0·593 „ . .	2·720 „
Same Coal at a High Temperature.			
4 hours. . .	9,770 feet. . .	1·829 feet . .	1·360 grains.
4 „ . .	9,770 „ . .	1·589 „ . .	1·232 „
4 „ . .	9,850 „ . .	0·727 „ . .	5·525 „
4 „	10,410 „ . .	0·882 „ . .	6·332 „
4 „		0·893 „ . .	7·480 „
4 „		0·575 „ . .	4·420 „

Escouffiaux (French) Coal, containing 18·80 lbs. of Sulphur per Ton, distilled for Four Hours at a High Temperature.

11,920 feet.	3,390 feet 1st hour. . .	Products lost.
	1,624 „ 2nd „ . .	12·937 grains.
	2,082 „ 3rd „ . .	11·021 „
	3,072 „ 4th „ . .	13·068 „
	Average	12·342 grains.
11,270 feet.	2,360 feet 1st hour. . .	7·362 grains.
	3,001 „ 2nd „ . .	5,968 „
	3,001 „ 3rd „ . .	6·229 „
	3,425 „ 4th „ . .	5·881 „
	Average	6·335 grains.
11,550 feet.	2,076 feet 1st hour and 45 min.	7·666 grains.
	1,907 „ 2nd „ 53 „	6·273 „
	Average	6·969 grains.

Mr. MICHAEL: Will you explain to the committee what was the test you made use of with respect to sulphur?

Witness: I made experiments in London, to see what was the real quantity of sulphur in the gas at that time, and to see if there was a practical way to take the sulphur out, or to reduce it. I tried it in a laboratory by all the tests that are used at this moment, and I did not find that there was any practical way to take the sulphur out. What was proposed at that time was lime, as it is now, but I did not think that lime could be used on a large scale in a city like London. The other process, I think, was that of Mr. Bowditch, who seeks to heat the gas to get out the sulphur compounds which are not sulphuretted hydrogen, and afterwards to take the sulphuretted hydrogen out, but I do not think it is possible to do that on a large scale. It is quite impossible, in manufacturing gas, to raise it to a regular heat without destroying the illuminating power.

Is there anything whatever done in the process of the manufactures of gas in London that would make a larger quantity of sulphur compounds in the gas, other than sulphuretted hydrogen, as differing from the mode adopted in Paris?—I think just the contrary. When I was in London, in 1864, they were heating at a much lower temperature than we were in Paris; and the experiments show that, if you produce gas at a higher temperature, you have more sulphur in the gas than if you produce it at a lower temperature; so that I think all the conditions of London ought to produce less sulphur than if we distilled the same coal in Paris.

Owing to greater heat employed in the distilling process in Paris, there would be likely to be, all things being equal, a larger amount of sulphur compounds there?—I think so. It is not only the question of ammonia; but there never was any test made in Paris about the effect of ammonia kept in a sufficient proportion in gas.

Cross-examined by Mr. CRIPPS: The Paris Company are always increasing the consumption of gas in Paris, and they do as much as they can to make the most perfect gas, even if it is not asked for by the Municipality.

Mr. CRIPPS: You know that the rule here is the same as in Paris, that of entirely prohibiting the presence of any sulphuretted hydrogen in the gas; but in London, over and above that, we do not allow more than a certain quantity of the sulphur compounds to be present in the gas when it is burnt?

Witness: Yes.

Your treaty in Paris has been kept faithfully by the companies, has it not?—Yes, it has. I think during the 17 years which it has been in work there have only been three cases of action against the company for not having purified their gas sufficiently.

With reference to the same question, you stated that the coals used for the manufacture of gas in Paris are more free from sulphur than the English coals?—I did not properly say what I meant to say. There are different sorts of coal used in Paris, which are bought simply for the price; the company do not at all care about the sulphur in the coals when they buy them. Of course, they would not buy coals containing a great deal of pyrites, because the purification from the sulphuretted hydrogen would be more difficult; and if they could have pure coal, of course they would buy it. The French coals they use generally come from the Pas de Calais; they do not use much Denain, and not much Belgian coal now, because they use a great quantity of English coal and German coal, which they get from Ruhr, near Dusseldorff, and partly Sahr coal. The absolute quantity of sulphur in those coals is about the same, but the way the sulphur is contained is different. In the English coals there are more pyrites than in the French coals, and these Sahr coals have more pyrites still than the English coals; but those are not tested in an experimental way by the company. It is only a sort of science that we make a study of in the company; but when we buy coal, we do not test for sulphur at all.

Though you do not test when you buy the coal, have you not performed experiments and tested to find the quantity of sulphur in 100 cubic feet of gas from French coal?—Not generally. I only once made an experiment in Paris, and that was in 1864, and was done for a special purpose.

The late Mr. Barlow, of London, was associated with you, was he not?—He asked the Paris Company for an engineer or director of the Paris Company, and I was asked to come over to make these experiments in London, and a special report to Mr. Barlow, and Mr. Barlow made afterwards a report to the company. I found that the Hornu coal, which was used at that time in Paris, gave about 6 grains in 100 feet. It was a test made by Dr. Letheby's apparatus, but the test has been changed, and there is now a test in London that gives 40 per cent. more than the Letheby test, so that if these tests had been made by the new test, I suppose I should have found 40 per cent. more than I did then, which would have been 10 grains.

How long is it since you have taken to mix English coal for gas-making at Paris with your own coal?—It is a very long time ago. I know that

when I was here in 1864 I made a contract myself with Mr. Elliot for a great quantity of English coal; and it was in use at that time, so I do not know when it began.

Can you tell us about what proportion of English coal is used to French coal now?—I am no longer engineer of the Paris Gas Company, therefore I do not know what are the coals they buy and in what proportion they buy them. I know they use different coals, but I do not know at this moment the proportion. They are using a great quantity of German coal at present, because it is very cheap.

Cross-examination continued: Another French coal I experimented upon was the Denain coal, and the quantity of sulphur compounds contained in that coal was less than 5 grains, I think, with Dr. Letheby's apparatus. I do not know how it is now, but with that apparatus you got very irregular tests.

Mr. CRIPPS: Are you able, at the present time, to give us any information as to the quantity of grains of sulphur in 100 feet of gas made from French coal?

Witness: Nobody makes experiments at Paris about that; I do not think there is even an apparatus for testing it. I could do it by comparison, as we use about the same coal that you do, and we purify with oxide of iron; I think that we must have about the same quantity as you have.

I suppose, during the war, you did not get any German coal at all?—No; we have only had this German coal since the war.

Your shops in Paris are very much more open, are they not, and better ventilated, than ours?—Some shops are well ventilated, and others are very badly ventilated. I think the new shops in the Louvre are very badly ventilated.

The COMMITTEE: Is the result of your evidence that, supposing the Paris gas was tested for the sulphurous compounds in the same way in all respects as the London gas is tested, you have no reason to suppose that a smaller amount of sulphurous compound would be found in the Paris gas than in the London.

Witness: I think that if you use Belgian and French coals in certain proportions, you would have less sulphur than in the English coals, but as there is a mixture, perhaps we should find 15 grains. I could not say at all what would be the quantity, but I think it ought to be something between the results which I found with these French coals and the results of the English coals. Our gas is manufactured at a much higher heat, and, therefore, there would be very much difference, but it is difficult to say the exact quantity.

You could not, in fact, make a sufficiently exact comparison in order to form an opinion?—I do not think so; we do not find it at Paris of any interest to get these proportions. The quantity of sulphurous products depends not only upon the quantity of sulphur in the gas, but also upon the quantity of gas burnt in a room; and, of course, in Paris we burn a much greater quantity of gas in the same space, for pictures, and things like that, than is generally done in London. At the Paris Opera, if there is a ball there, they burn in the night 12,000 cubic mètres—that is more than 400,000 cubic feet—of gas; and if there was a great deal less, even half the sulphur in the London gas, they would have found that with the pictures there it would be a very great danger to have such a great quantity of gas burnt, but that was never so. There was no injury at all found in any place in Paris, in the theatres and in these great shops where they burn an immense quantity of gas, so that the Municipality have never asked us to test even for the quantity of sulphur.

Do you attribute the difference mainly to the difference of the coal?—I think, as a theory, it ought to be that if you have more pyrites in the coal, you have more sulphur compounds which are taken out of the pyrites.

Dr. *Charles Meymott Tidy*, examined by Mr. MICHAEL.

I am a Bachelor of Medicine, a Fellow of the Chemical Society, Professor of Chemistry and Medical Jurisprudence and Public Health at the London Hospital, and Medical Officer of Health for Islington. I was for many years the colleague, and am now the successor, of the late Dr. Letheby, in the chair of chemistry at the London Hospital. I have paid considerable attention to the gas question, and am scientifically acquainted with the manufacture and supply of gas. I have considered this matter, not only chemically, but from a medical point of view. I know of the present regulations in force as to the sulphur compounds in gas, and I certainly think that there is no need for such restriction as 15 or 20 grains per 100 cubic feet. So far as free sulphuric acid is concerned, if there is any produced, by the combustion of gas, it is in the very smallest possible quantity—infinitesimal, I may say. I am convinced of this, that, if the sulphur present in gas was oxidized to sulphuric acid, the amount of damage that would be produced would be so enormous that there could be no doubt whatever as to its presence.

Mr. MICHAEL: Going from sulphuric acid to sulphurous acid, is there any such amount of that acid, or would there be any such amount of sulphurous acid formed, if the maximum were increased, say, to an average of 33 grains—which we understand to be the average, when oxide of iron is used as the purifier—would 33 grains, or even up to 40, cause such a formation of sulphurous acid as would be injurious to property?

Witness: I do not think it would.

I think you have samples of books and various materials in the very first inquiry which was instituted at the instance of the Athenæum Club?—Yes, I have [producing the same]; these were the original samples upon which all this inquiry was instituted. That was, I believe, the original book upon which the whole of this sulphur question arose [handing a book to the chairman], and here I have samples of the covers of books at the Athenæum which are supposed to have been injured by the sulphuric acid that was formed by the gas. I have a great many samples.

I will not trouble you to go over the whole of the samples; but do any of them furnish evidence of sulphuric acid being the agent of destruction in any individual case?—I think not; there is quite sufficient cause to account for the action which has taken place from the carbonic acid produced, and the large amount of heat evolved as the result of the combustion of gas.

Do you agree with Dr. Odling, that the disagreeable effect complained of in the burning of gas proceeds partly from the carbon products, and also from the dryness and heat of air produced by the combustion of the gas?—Yes; I think so. I can honestly say that I have done my best to find free sulphuric acid produced as the result of the combustion in a somewhat large number of gaslights in my own dining-room, and I have failed.

I think your process at the present time for detecting sulphur is rather better than that established by the late Dr. Letheby?—Yes. I would say, with respect to the history of the sulphur test—it is right I should refer to it, as it has been already mentioned, and I know something of the history of it—when that sulphur test was originally suggested by Dr. Letheby, he used large cylinders. Somewhere about the year 1860—it might have been 1859, but I believe it was 1860—those large cylinders were abandoned, because Dr. Letheby found that by the use of small cylinders he obtained a larger quantity of sulphur. It certainly was not because he obtained a smaller quantity of sulphur.

Tell me the quantity; if it were 20 grains produced by a large cylinder, what would that equal if a small cylinder were employed?—I am speaking of the cylinders of Dr. Letheby. I can scarcely give the actual proportions of those two. But with the cylinder used by the Gas Referees, which is a very much smaller one, I have made some very careful experiments, and I find that the difference is as near as possible 6 grains between Dr. Letheby's small cylinder, and the apparatus now used by the Gas Referees.

That is to say, that the apparatus which was competent to discover 20 grains, would, if now employed, discover 26 grains?—Yes; as nearly as possible.

Do you believe that there are any sulphur compounds evolved in the combustion of gas which are injurious to health—I mean after the purification by oxide of iron, even up to a maximum of 40 grains per 100 feet?—I am strongly of opinion that sulphurous acid is not injurious to health. I may say it is a matter upon which I have had occasion to make a great many experiments, and though, in the first instance, in breathing sulphurous acid there is a slight irritation produced as the result, I quite admit that directly that irritation wears away, the action of sulphurous acid is somewhat antiseptic rather than otherwise. I am quite convinced, as the result of large numbers of experiments, that sulphurous acid is not a gas which, in moderate quantity, is injurious to health.

What would you put as the quantity which would have been necessary, before even this sensation which you have described would be produced?—I do not know. I should scarcely like to fix the exact quantity. I have not a sufficiently accurate account of that, but it is nothing like the amount produced by any ordinary amount of sulphur in the gas in an ordinary room.

I will put to you an average of 33, and a maximum of 40. Would that produce it?—Oh dear, no.

Do you know, to put it generally, any results which could occur either to persons or to property, of a disadvantageous kind, by the burning of gas with 40 grains of sulphur contained in it?—I do not. I think it is right I should say, as had been said before by a witness, that if gas was offered with a small amount of sulphur at 3s. 8d., and with 40 grains at 3s. 6d., I should choose the 3s. 8d. gas; but, at the same time, having said that, I should say it with one proviso, and that is, that I did not live in the immediate neighbourhood of the gas-works where that sulphur was removed.

I am not putting it to you as a question of expense, neither do we present it as a question of expense to the committee. I am putting it to you as a question absolutely whether you know or believe that any injurious effect could be produced, by the burning of that gas, either upon health or property?—No, I do not.

Having devoted attention to the matter, do you agree with the other witnesses, that where oxide of iron is employed at the works, and a small quantity of lime is used to take out the carbonic acid, the maximum would be 40 grains, and the average might be taken as 33 grains of sulphur in 100 cubic feet?—It is somewhere from 33 to 35.

Examination continued: I do not know any other mode which can be adopted, if the sulphur compounds, other than sulphuretted hydrogen, are to be taken out, than the adoption of lime as the purifier; and I do not believe that it can be so employed as not to create a nuisance. Sulphuretted hydrogen, even in small quantities, cannot be inhaled without producing bad effects upon health. I can only say that, in the course of my lectures on toxicology at the hospital—this was before the Vivisection Act came into force—I was always accustomed to show the effects of an atmosphere containing one per cent. of sulphuretted hydrogen by putting a sparrow into it, and the sparrow dropped down dead immediately. I showed it at one part in a hundred; but I could have reduced it very much indeed. There have been a large series of experiments made upon the action of sulphuretted hydrogen; the earlier experiments were made by Parron de Chatillet, then Barker, and then Dr. Letheby; and I believe they all agreed very nearly in one fact, that small birds died after a time when there was one part of sulphuretted hydrogen in, according to Parron de Chatillet, 1500 of air; according to Barker, 1800 of air; and according to Dr. Letheby, 2000—that one part in 2000 would be fatal to birds; and then, when we come to dogs, it has been found that one part in 200 will destroy the life of a dog.

Mr. MICHAEL: Putting it not as a matter of destroying life, but as to injurious effects upon health, do you believe that a comparatively small quantity of sulphuretted hydrogen in atmospheric air, employed as the ordinary medium of breathing, will produce injurious effects to a person in an ordinary state of health?—Most assuredly.

Such an amount as would be likely to arise after the process of emptying the purifiers?—I should think so, most assuredly.

Have you seen instances of injury to health from sulphuretted hydrogen?—I have, in the case of sewer gases, very frequently.

Is there any particular difference between the sulphuretted hydrogen evolved in a sewer or from decomposing organic matter, and the sulphuretted hydrogen given off from the opening of the lime purifiers?—No; I am convinced of this, that the active agent in the case of sewers is sulphuretted hydrogen, and I think that is agreed on all hands.

Generally, do you consider—according to the evidence we have had before us, it is inevitable that some amount of nuisance must be created by the use of lime as a purifier—there is any corresponding advantage in the abstraction of the 10 or 15 grains of sulphur which the lime would take out of the gas?—No; my own feeling in the matter is, that I should be very glad to have no sulphur at all, but the objections arising from the process of the removal of the sulphur seem to me to be infinitely greater than any harm it can possibly do by remaining in the gas. As a matter of fact, putting it in another way, the difference between 20 and 35 grains of sulphur in the gas really amounts to this: Say the difference between 20 and 35 is 15 grains, and say there are two burners in a room, burning three cubic feet each an hour for four hours—that would be 24 feet. Every sulphur match has in it about one grain of sulphur, and the whole discussion between 20 and 35 grains is really as to whether three sulphur matches may be lighted during the evening.

The COMMITTEE: Do you mean to say that the ignition of three sulphur matches in a room would produce as much sulphuric acid eventually as the combustion of the amount of gas you have mentioned?

Witness: Yes; taking the actual facts. It is not an opinion in any way. But even that is not an accurate comparison, because in the case of gas there is some ammonia present, which neutralizes any fumes that are produced, whilst in the case of sulphur matches there is no ammonia present; that is the actual fact of the case.

We did not hear from the French witness that the ammonia neutralized the sulphurous compounds after combustion, but it was only before combustion that it was held in suspense, as it were. On the contrary, the witness said positively it would not have any effect after combustion. The question you were asked was this: Do you mean to say that burning an ordinary sulphur match, or four of them, would produce as much of the injurious sulphurous compounds as the burning of two gas lights?—Yes. I have made a large number of experiments as to the amount of sulphur on those matches, and I can say that as a rule it is over one grain, but ordinarily one grain may be taken as a very low average.

Can you say that on striking a lucifer match the fumes it gives off contain a grain of sulphur, which would be spread through the room in the same way as the sulphurous compounds come from gas?—Yes;

wherever sulphur is found, it is no matter whether it is in combination or not, the facts are the same.

Mr. MICHAEL: The rule is, in a sulphuric acid combination, or in any other combination, that when sulphur combines with oxygen, it will combine in definite proportions, whether you have it in the solid form, or in the vapour of gas?

Witness: Yes.

You have given a homely illustration. If we could collect the products of combustion in a bell-glass we should have precisely the same, whether four matches were burnt, or we had the same quantity in gas; and therefore one thing would be that you burn the four matches altogether, and in the other case you have four hours during which the whole quantity is diffused?—Yes.

Is there any other difference?—No.

Looking at the triviality of such a quantity, and the possible effects of it, is it worth while to run the risk of all this complicated process, and the nuisance which is almost inevitable from its use, to get rid of such a thing?—I should prefer not to have four sulphur matches lighted; but, knowing the injury that results from the process of taking away the sulphur from gas, I think it is infinitely worse than the presence of the sulphur.

You know of no other means, neither has any chemist suggested any other means, which practically are effective, without the use of lime, for getting rid of the sulphur compounds?—I do not know of any.

Cross-examined by Mr. O'HARA: I have not seen the process of purification in operation at the works, because the purifiers have been shut on my visits to the works. I am not a practical gas-maker, and what I say is theoretical; but, of course, it is regarding the matter from a purely scientific point of view. I say that in a sulphur match there is, on an average, one grain of sulphur, and when you burn that match, the sulphur becomes sulphurous acid as the result of burning it. The amount of sulphurous acid produced is actually fixed and definite.

Mr. O'HARA: Are you referring to some antiquated cast-off kind of match?

Witness: I am referring to a sulphur match. I am not saying whether it is old or new. I am not referring to Messrs. Bryant and May's matches, because they use paraffin.

Did you ever weigh the sulphur on one of these old matches?—Yes; I have, upon more than one occasion, very accurately weighed the amount of sulphur. It became a great question once as to how far that sulphur could be kept down, and upon that occasion I weighed the wood very carefully. It was then dipped in sulphur, and I took the weight after, in order to determine the amount of sulphur present.

You said the ammonia in the gas neutralizes a certain quantity of sulphur in the gas?—It is not the ammonia in the gas that neutralizes it, but there is ammonia in the air neutralizing it.

Then with the two ammonias combined?—I cannot say at all.

Can you go anywhere near it?—No; I think that is a matter which varies so much that it would be impossible to give you an opinion.

You agree with Mr. Vernon Harcourt, that if you could get gas at 3s. 6d. per 1000, in which there was an increase of sulphur compounds, and if you could get gas for 3s. 8d. without the sulphur compounds, you would prefer to pay the 3s. 8d.?—I should.

Let me take you from a question of chemistry to a question of honesty. Supposing you agreed to give a man gas at 3s. 8d., free from sulphur compounds, and it cost you 2d. to purify it, and then you proposed to give him gas with sulphur compounds, and not alter his price—would you think that fair?—No. I think that this question of the purification of gas ought not to be a money question. If I could see my way to suggest that the gas company should keep their sulphur down to 10 grains, even if it cost them an enormous sum, I do not think that I would venture to give evidence here to-day upon this subject. I feel very strongly that, if the sulphur can be removed, it is not a question of expense at all that ought to influence it; and I will even go further on your side by stating that I do not quite advocate making the sulphur an open question.

Supposing—we will assume a more violent supposition—supposing this committee were to relax the test for the impurity of sulphur, would you think that it would be fair that they should diminish the price as well?—That really is a question I must not enter into; I do not know the question of price. Regarding the consumer on the one hand, and the manufacturer on the other, I think that the limit of sulphur—it is only my opinion, of course—might be fixed at 35 grains, and I hold that view very strongly. I also hope that even that amount will not be permanent, because I trust that as science progresses means will be shown by which the sulphur can be removed. I should be very glad to have no sulphur in the gas at all; but, as science is at present, I feel that Parliament might very fairly, in the interests of the public, and in the interests of the gas companies, reduce that sulphur to 35 grains.

But, beyond that, you think it is very dangerous?—No; I did not say it was very dangerous. I said I desired to reduce any impurity—and I admit sulphur to be an impurity—to such a quantity as that it should be removed without causing in any way a nuisance to the public.

The COMMITTEE: Which do you mean, an average of 35 grains, or a maximum?

Witness: I mean that a matter of that kind should be taken on an average of three days—that if the sulphur was more than 35 grains on an average of three days, the gas company ought to have to pay for that sulphur being in.

Mr. O'HARA: The present penalties (I do not know whether you are aware of this) are only levied on the average of three days?

Witness: I believe that is the case, and I think that is very fair. Of course, you are always obliged to trust a certain amount in an average of three days—that is to say, even taking 20 grains, they may have 40 on one day, and none the next, and, therefore, your average of two days would still be 20 grains.

You know, of course, you could fix a small maximum, such as 20 grains, and prevent this excessive average?—Yes, but the difficulty of that is the use of this lime process of purifying, where the undoubted existence of a nuisance is so clear.

Supposing it were demonstrated to your satisfaction that this process of purification could be carried on without a nuisance, would you then be for 20 grains always as the smallest amount of sulphur?—I go in for none at all—that is to say, if the sulphur could be reduced to none at all, I should be very glad to have it; but I am convinced, in the present state of science, that there are no means whatever, without producing a nuisance, of its being reduced to that.

Have you ever made any experiments as to purifying in gas-works?—I have tried laboratory experiments, but only those by the Bowditch system. I have heard from others of their trials, and I know very well the smell of a purifier when it is opened, but I am obliged to accept in some degree other people's tests for these matters.

To make any experiment valuable, ought it, in your opinion, to be derived from practical experience in gas-works?—I consider that you must try every experiment on a large scale before you can form a proper and true estimate of the results of that experiment.

You yourself have not tried them on a large scale?—No, I have not.

The COMMITTEE: With regard to your evidence as to the injury caused by the presence of this sulphur in the gas, do you think there is any injury except the irritation of the throat?

Witness: No. I can give you an illustration on a large scale of that. One of the first cases I happened to be engaged in professionally was the atmosphere of the Underground Railway, and I made, in conjunction with Dr. Letheby, in 1861, I think, a very large number of experiments on that question of sulphur, and the result of our experiments was, that, though undoubtedly there was a slight irritation set up at first, that irritation never had any injurious effect. I will tell you another thing with respect to that sulphur. At the time of the inquiry all the railway men on the Underground Railway subscribed to a club, and they had applied to that club to have the weekly sum they paid in reduced, because so very few cases of illness occurred among the men. It is perfectly wonderful the amount of sulphurous acid you may have in the atmospere. As regards the injury to books, furniture, and so on, I am quite convinced that the excessive heat and the relative dryness of the air which we have heard so much about, is sufficient to cause most of the injury, or nearly all. There may be, in my opinion, a little acid sulphate of ammonia formed.

You say it is of enormous importance that ultimately these sulphur compounds should be entirely got rid of. Is there any substantial injury that you consider is done to any living person or to any object around us except the irritation to the throat which you have spoken of?—No, I am quite convinced there is not—not by such a quantity as the difference between 20 and 35 or 40 grains.

Mr. MICHAEL said that was the case on behalf of the promoters.

WEDNESDAY, MAY 16.

The CHAIRMAN said as the case of the promoters was closed, he thought it might simplify and shorten the proceedings if he stated what the view of the committee was at that time. The promoters by their Bill asked that the 30th and 51st sections of The Gaslight and Coke Company's Act (their last Act) should be repealed; that was to say, the section which established the authority of the Gas Referees for the purpose of controlling the company, and in order to obtain a certain degree of purity in the gas. It was objected by the Metropolitan Board of Works, by the 6th clause of their petition, "That, as your petitioners are advised, it is of the utmost importance that a proper limitation should be placed upon the amount of impurity in gas, such impurity being highly detrimental to the sanitary condition of the Metropolis, whereas, if the Bill is passed into law, it will be in the absolute discretion of the company to supply gas with any amount of impurity, either of sulphur and ammonia and of the compounds thereof." The Corporation of London, also, in their petition, said that if those clauses should be repealed, "they would be left to the mercy of the said company to supply them with gas charged with any amount of impurity they pleased; and it has undoubtedly been proved, before more than one committee of your honourable House, that the impurity contained in the gas is most injurious and detrimental to health, and causes vast injury to all descriptions of goods and merchandise." If the case rested there, the committee thought that no other course would be open to them than to declare the preamble not proved. But, a suggestion had been thrown out by Mr. Pope, to the effect that if the committee came to the conclusion that there ought to be some restriction, then justice would be done between the company and the public, by restricting the power of the Referees to the maintenance of a test, the minimum of which should be of such an amount as, in the words of the Act of Parliament, would render it possible to maintain a reasonable amount of purity. The committee were desirous, if they could so arrange it to the satisfaction of both sides, to adopt Mr. Pope's suggestion in a modified form, but, of course, they were quite ready to hear what might be said by the petitioners if they should not agree with that suggestion. The terms the committee were disposed to offer to the promoters of the Bill were that the limit of impurity as to sulphurous compounds (as regards the other impurities they did not propose to make any change at all) should be fixed, experimentally, at all events, at such a limit as would make it possible to avoid what was called the lime process of purification. At the same time they would require that the line so fixed in the Bill should not be reduced, unless by direct order from the Board of Trade.

Sir E. BECKETT: When you say that it should not be reduced, does that mean, supposing we start with 40 grains, it should not be reduced below 40 grains.

The CHAIRMAN: Yes; that is to say, that the Gas Referees, in the exercise of the discretion vested in them by the 30th section, shall not reduce the limit below 40 or 35 grains, or whatever we arrive at, as the lowest limit which can be attained without the use of the lime process, unless by direct order from the Board of Trade.

Sir E. BECKETT: To put it in a cognate form, it comes pretty much to this: Supposing we agree that 40 grains is the limit that can be reached without lime, then you would take 40 grains, assuming it to be so—as the maximum, in short.

The CHAIRMAN: As the maximum.

Sir E. BECKETT: And also as the minimum, unless the Board of Trade otherwise order?

The CHAIRMAN: Yes.

Sir E. BECKETT: That is a matter that requires a little consideration.

The CHAIRMAN: I am not sure that you understand about the minimum. What we mean is that the average that would be obtained in that way, as I understand the evidence, would be an average of about 33 grains.

Sir E. BECKETT: The average seems rather doubtful in this case.

The CHAIRMAN: Therefore we say the maximum. We say that the Gas Referees are not to reduce it, and in that sense you are quite right, it would be the minimum. The Referees ought not to oblige the company to keep the impurity arising from sulphurous compounds below a limit of 40 grains in 100 cubic feet.

Sir E. BECKETT: As you have just now mentioned 33 grains as an average, would you put 33 grains at once into the Bill, do you mean?

The CHAIRMAN: No, because that I believe is not so convenient a method of doing it. There is also another question upon which we should like to hear what you have to say—namely, whether we might not fix the maximum 35 grains, and give an average of a week instead of three days. I likewise think there is another condition we should have to impose upon the company if they are disposed to agree to these terms, and that is that they should, from time to time, make such reasonable experiments as the Board of Trade might require.

Mr. RICHARDS: Most certainly; we have it as much at heart as anybody can have.

The CHAIRMAN said there was another question which would afterwards have to be considered. Mr. Pope had put the case as between the company and the public, but the committee were not disposed to make any concession to the company in their interest alone, under the circumstances of the case, they having last year obtained their Act, and having agreed to the principle upon which that impurity was at present restricted. The committee did not think that the company, as such, had any *locus standi* to complain at all, but they certainly had made a case on behalf of a certain portion of the public, and the question was one between the consuming portion of the public and that portion who were suffering

injuriously from the nuisance arising out of the purifying process at present adopted; and, therefore, after they have agreed upon that part of the case, they would be glad to hear anything that might be said by those representing the public—the Corporation and the Metropolitan Board of Works—as to the financial question; that was to say, as to whether any terms should be imposed upon the company with reference to the price at which the gas should be sold to the public. It was quite plain that if no such provision were made, there would be a very considerable economy for the company, and that would represent a considerable advantage financially, as well as in convenience and other ways. He (the chairman) was not quite sure that he was right, but he thought, as far as he understood the case, that that advantage would be only partly shared by the public under the system of the sliding scale; the alteration of the system at present adopted would go to reduce the cost of the gas, and part of it would go into the pockets of the company. If those views were accepted, the committee would require further evidence on the question, whether the quantity should be 40 grains, taking the average ascertained on three days, or 35 grains on the average of a week.

The parties retired to consult, and, upon their return.

Sir E. Beckett said: I am sorry we cannot save any time. We think that we ought to go on, and also that, with a view to proceedings hereafter, it is not expedient to withdraw any of the evidence.

Mr. *George Anderson*, examined by Sir E. Beckett.

I have been engaged for about thirty years in managing gas-works, and am lessee of several now. I have considered the subject of purification, and have read several papers upon it, one of which obtained the premium from the British Association. I manage gas-works at Dover, Waterford, and three or four other towns that I need not name. I am engineer to the Cork Gas-Works, and to a number of other gas-works. In no case am I under any restrictions as to sulphur, excepting sulphuretted hydrogen. Although not under restrictions, I have managed to get my sulphur down to about 15 grains. I have always considered, as a lessee, that it was my interest to have as much gas consumed as possible; and as I thought that the purer the gas the more would be burned, I have paid a great deal of attention to the subject, and I have my gas as pure and salubrious as possible for that reason. I use precisely the same coal that is used in London—Ravensworth Pelaw and Pelaw Main. I do not know anything about the Paris gas, or the coals they use there. I have used the same tests as they do in London. I had my offices fitted first with Letheby's test; afterwards with the Referees test; and more subsequently, being a more facile arrangement, I have used Mr. Harcourt's test. The result I have obtained is from 10 to 16 or 18 grains.

Sir E. Beckett: Of course the important question comes, what means do you use for arriving at those results?

Witness: In that sense I use means a little different from what they do in London. I am very particular, first, in the cooling of the gas; next, in the washing of it; and next, in the scrubbing of it, so as to remove a very large proportion of the impurities before the gas enters the purifier at all. My objection, and I have stated it before, is to the fact of finding so much sulphur in the gas in London, which is due to the previous processes. They have not, in my opinion, been so scientifically attended to as I think they should be. More stress is laid upon the purifiers, and consequently there are more impurities to be removed by them, and more difficulty in doing it. I use both lime and oxide. I have not had any complaints of nuisance for several years. About eight years ago I had one at Dover; but then it was because our works were incomplete. We had only two purifiers there at that time, and we could not work upon the system as we ought to do, and we did certainly have some nuisance; but since we have completed our works we have not had any complaints for many years. I have heard of some people complaining at Cork, but nothing ever came of it; there was never any action, or anything of that sort.

You are confident, are you not, that, by taking means that are known to practical people it is possible to reduce the quantity of sulphur below 20 grains without incurring any nuisance?—Yes, with improved apparatus.

Is it very expensive, that is another thing to ask?—No, it is not any more expensive than the apparatus now employed, but they require more of it. I would even go beyond that, and say that if investigation upon this subject is not opposed by legislation which will not require purity, my opinion is that we shall go on making gas, and arrive at even lower than that—perhaps to eight or ten grains.

Mr. M'Minn said that science was never to advance in that direction. Do you think so?—I think the very opposite of that; I think it is advancing very rapidly.

You think that if people are kept under a little decent pressure, they will soon find means of reducing the sulphur to 10 grains?—I think it would be to the interest of the companies to do so, because the purer they make their gas the more of it will be burned, especially in a place where a good deal is burned in the daytime.

You seem to think that there is something in the sulphur after all; that is not a desirable thing?—I do not go so far as some people talk, as to its being injurious to health; but I believe it is injurious in this way, that it is unpleasant, and I am not quite sure that the products that come off when the gas is burnt are merely sulphurous acid. If it was sulphurous acid, I do not think it would be so unpleasant as it is; but I have had personal experience of headaches when I have been burning gas in my office in London, and I do not think that sulphurous acid alone would have done it.

Do you find the same result—headache, or whatever it may be—at the places where you have your own gas?—I have not had the same means of trying it, and therefore I should not like to make that comparison.

Examination continued: My plan is to keep the gas in contact with ammoniacal liquor, instead of draining off the liquor from the gas, as is often the case. The ammoniacal liquor has an alkaline action, and it absorbs a large quantity of carbonic acid from the foul gas. I have done this for a number of years without really thoroughly understanding the chemical reason why I have got the benefit; but Mr. Patterson, about three or four years ago, discovered that while the carbonic acid remained in the gas, it was difficult to cause it to deliver up the bisulphide of carbon that causes the mischief. If, however, the carbonic acid was removed from the gas, and brought in contact with an alkali, there being less acid to neutralize the alkali, the acid sulphide of carbon would be attacked by the alkali—lime—which would therefore remove it. It so happened that my process was just following exactly in this line. I have always taken out as much carbonic acid as I could before bringing the gas to the purifiers at all. The consequence is, that all the gas engineers have expressed to me their wonder how I purified my gas with so little lime. I have stated the quantity of lime I use, and in comparing it with their cases, they have always said that I did not use above half the lime they did, and they did not understand it. I have explained to them that it was because I did not give the lime so much to do as they gave it. I do not know that I need go any further. I should also say that the doing of this renders the lime almost innocuous. If you thoroughly carbonate the lime—that is, allow the foul gas to go through it for a long period of time—you send the sulphur out of the lime, and you leave the lime a hard substance, like a porous stone, which has really no smell; you may put your nose over a purifier, and scarcely smell it. I have a piece of lime here [producing a sample], taken out of the last purifier we cleared, which was on Tuesday or Wednesday.

Sir E. Beckett: With regard to taking the lime away from the works, do you think that they manage that rightly in these London works?

Witness: Granting that they have a smell, I think they use a considerable amount of caution; but I consider they might do it even in a better way than they do. In the first place I must state, from what I have read recently, that when the lime is being taken out it is in a dusty state, and the dust of the lime blows about and causes the smell. I think that is exceedingly likely, but I contend that, by the proper use of lime, when it is taken out of the purifiers it should never be in a dusty state. You may pass foul gas through dry lime, and it will come out foul gas; but put some water in that lime, and then it is impossible for the gas to come out foul. You want the water to have contact, and then the lime comes out in a lump, and the pieces produced are those that come out.

The Committee: Those are dusty?

Witness: That is because they have been rubbed together in coming here. My lime is in lumps, and it has to be taken out with a pick. Another mode that I would adopt—and which I do not know that they have done—would be, before opening a purifier, to leave it, say for 24 hours, to cool, because when the stuff has cooled it has much less chance of delivering noxious gases than when it is warm, which it is when the purifier is shut off from making gas. I would also inject steam into the purifier after it was shut off, for the purpose of causing the lime to collapse and shut up the pores. When the lime is porous the oxygen of the atmosphere gets in through it, and delivers any smell that can be got from it. If you were to keep it in a state of pulp, partially pulped, it closes up the pores, and you might remove it, even if it had noxious ingredients in it, with much less smell than in a state of dust. Again, I should have a thoroughly closed barge that could be locked up—covered over with simply man-hole doors, the same as the hold of a vessel, so as to leave the chance of the air acting upon it as little as possible.

Can the sulphur be got out again, and the lime utilized?—If it were absolutely necessary that you must remove the sulphur compounds, and must not take away the lime, even then I say that I could take the sulphur out of the lime in the works, and use the lime over and over again for purifying the gas, the same as they take the sulphur out of the oxide and use it over and over again, and get the sulphur as a saleable article to sulphuric acid makers.

Have you ever done that?—I have not done it with the lime, but I have with oxide of iron. I mean to say that I have taken the whole of the sulphur from the oxide of iron which the companies now sell as useless, and I have used the oxide of iron for years and years without selling it, or taking it off the works at all.

Why have you not done it with the lime?—Because the lime in our case was cheap, and we did not consider it worth while.

They talk so much here about their being encumbered with a great quantity of lime—if they were so encumbered with it they might treat it in that way?—Yes, they might do so, and there are some people who do do it, I believe. It makes the lime caustic again—makes it ready for putting into the purifiers. It takes away the carbonic acid and all the impurities.

Cross-examined by Mr. Richards: My gas is not tested for sulphur compounds by any public officer, and the results I arrived at were merely for my own edification. My works at Dover are small as compared with London, but they are larger than many others; you must have things in proportion. I have never taken out a patent for my scheme of dealing with the lime. Mr. Patterson took out a patent for his discovery, but the novelty of it was disputed in Chancery, and he had one decision for him and one against him, but I have heard he is now applying to have another in his favour if he can get it, as he is going to appeal to the House of Lords. His process was disputed upon the ground of novelty, not of utility; for since the companies have used it they have been able to reduce the sulphur compounds to 8 or 10 grains. I was examined before the Revision Commissioners in 1874, when the company applied for an increase of price.

Mr. Richards: Did Dr. Odling, who was one of the commissioners, ask you this:

If all your lime coming out consists mainly of carbonate, I want to know in what form you take out your sulphur from the gas. If none goes into the purifying material, where does it go to?—Most in the scrubbers and washers.

I think you said your lime was sulphuretted to some extent?—Yes.

But not when you take it out?—Not when I take it out.

Sulphur is not a thing you can squeeze into nothing; you cannot squeeze anything into nothing. I want to know, in purifying gas in that way, what is the form in which you take the sulphur out?—I should very much like, if you could, during the bathing season, come down and visit it for yourself; the fact is, as I state, that we work our purifiers a long time.

You drive your sulphur from one purifier into another; you never take it out?—That is the something that takes place. At Beckton they have oxide of iron purifiers for the purpose of taking out the sulphuretted hydrogen at the last. I take out the sulphuretted hydrogen without doing so.

I cannot understand your taking out nothing but carbonate of lime, and yet removing the sulphur of the gas?—The same thing has gone through my mind that it will get by-and-by into that condition that it will be choke full, but it is not so; the gas is tested, and it would not do to have sulphuretted hydrogen in it.

You do not seem to me to give any satisfactory answer to Dr. Odling's question of what becomes of the sulphur?

Witness: As I have heard you read it, it appears that Dr. Odling was arguing from premises which I do not admit—namely, that I took the lime out pure carbonate.

I only ask you what Dr. Odling asked you, and that is, where is the sulphur? If it goes through the lime, where is the sulphur? You say it is taken out of the gas; where is it?—It exists in the lime in a state in which it does not give off so much smell, in consequence of the large quantity of carbonic acid in the lime.

Have you analyzed that lime to ascertain whether sulphur is in it?—I have not; but I have given samples of it to chemists, and I dare say it is possible that during this inquiry you may have an analysis.

You yourself are no chemist, I presume. You set yourself up as a gas engineer?—I do not profess to be a chemist, but I know more about the purification of gas than some chemists do.

Cross-examination continued: At Dover we have six purifiers, two filled with lime and four with oxide, and the gas is passed through the lime first, and then through the oxide. Our old works were situated under the cliffs, but they have been abolished, and new works erected a little way outside the town, about 40 feet above the lowest part of the town. The old works were complained of by the people in Marine Parade, but it was more on account of the smoke than anything else, and they were never serious. In those old works we had not the means of purification which we have in the new ones. We worked with the old purifiers, and the arrangements of 20 or 30 years before that; and the reason for removing, I may say, was twofold—one was that the works were in the town, and another was because the place was altogether too cramped—in fact, we had no room to do anything.

Mr. Richards: You say it is not difficult to deal with lime with proper apparatus. Is that an apparatus that you have invented?

Witness: No, it is not; but I would invent it if I had this thing to do.

You mean to say that if this problem was submitted to you, you could deal with it very easily?—I do not doubt it at all.

Have you got what you describe as proper apparatus in action anywhere?—I have not required it.

You have not had any practical experience of this proper apparatus?—Yes; I have had experience of a proper apparatus, but not for carrying out the necessity that exists here of taking away these smells. I should like to give my reason for this. Taking that little box represented there as being the thing to put some oxide of iron into, and the exhauster for drawing air up from the large purifier into it and through it, I think any person would expect to get a smell under such circumstances; that box should be six times as large as it is. The gas coming from the purifier through that very small thing would be passed through it at a very considerable velocity, and I believe that it would come through only partially purified. There would be some impurities that would go through, buted if that vessel had been six times as large as it is, and the gas were allow to go very slowly through the material, you would have a far better combination, and you might not have any smell from the surface of the vessel.

You know that the operation proved a failure. Have you ever tried a large vessel?—I have tried this, which is the same thing.

Will you answer the question, and then explain afterwards?—In the first place, I say no; then I give this explanation. When you have a small purifier in proportion to the gas made, you require double or treble the amount of material for doing the same amount of work. If you enlarge your purifying surface and the gas goes through slowly, so that the products of the gas and the lime come slower in contact and hug each other more slowly, you get a combination to take place which does not take place if the gas is rushing past the material. If that is the case with your large purifier, what is the small purifier but purifying the gas a second time?

You would, under the circumstances, not multiply?—Not multiply, but magnify. Magnifying is better than multiplying, because if you multiply you must send through each vessel in succession, and at the same velocity; but if you magnify you get a lower rate of speed from what you otherwise would do.

What are the limitations as to sulphuretted hydrogen and sulphur compounds in the Dover Act of 1860. Is it not that you shall be free, as far as possible, from sulphuretted hydrogen and other compounds deteriorating its purity?—It is in those exact words; but I may state that we have an inspector of gas who is daily testing the gas, both for ammonia and for sulphuretted hydrogen, and really I should have no objection if he were to test it for sulphur compounds.

Re-examined by Sir E. Beckett: It is not requisite at large works to have any different mode of purifying to that in use in small ones; only larger apparatus. What answers for 400,000 or 500,000 feet will answer for 17,000,000 feet if of larger dimensions.

Mr. *Clarence William Raymond*, examined by Sir E. Beckett.

I am Inspector of Chemical Factories to the Poplar District Board, and know generally the process by which the gas at the Bow Common works (which are in my district) is purified. It is by lime and oxide. At the present time that process does not cause any nuisance. I have often been present when the purifiers have been opened, and have seen the lime turned out. When the lime purifier is turned off, the lids are raised, and the air is drawn through from 18 to 24 hours before the lid of the purifier is lifted off—that is, passed through the oxide of iron, and anything that escapes from the oxide of iron passes away into the flue. We experience no nuisance from it now, neither have we had any complaints with reference to the works since October, 1875; before that we used to have a great number of complaints. Acetate of lead paper is not at the present time blackened by the effluvium. The lime is employed twice over. There used formerly to be a great nuisance, especially through the emptying of the purifiers, and after the lime was lying there; but they were threatened with an action for nuisance, and since they adopted the mode they now employ there have been no complaints of nuisance since. The gas-works are surrounded by houses, some within 30 yards. As to the use of lime, the farmers cart it away; in short, I am perfectly satisfied with the present condition of things.

Cross-examined by Mr. Richards: The Bow Common station is one of The Gaslight and Coke Company's works.

Mr. Richards: Do you think it intelligible that they should conduct their works in this way in one place, and neglect the best course of proceeding at another station?

Witness: I speak as I find those works; I cannot say what they carry out at others.

The particular neighbourhood in which the Bow works are situate is not what you would call a very savoury neighbourhood?—No; at times it is rather bad.

A stink or two, more or less, does not make much difference?—No.

You speak of houses near. What sort of houses are they—factories or chemical works?—No; dwellings of from six to seven rooms, I suppose.

Sir E. Beckett said before he called the next witness, he would ask the committee whether they thought it desirable to have more evidence upon the question of the injuriousness of the sulphur itself. He rather understood they wanted to have evidence upon the question of getting rid of the nuisance of the lime.

The Chairman said the view the committee took was that, of course, it would be a great advantage, if it were possible, to get rid of the sulphurous compounds altogether; but that as a balance of convenience between the degree of the increased amount of sulphur, as between 20 grains and 40 grains in the 100 cubic feet, and the nuisance of the lime process of purification, they were disposed to have the experiment tried. The clause he had suggested would enable the Board of Trade at any time, in the first place, to have such an experiment as they had just heard of tried at the works of the company in London; and in the second place, if they thought a case was made out for such an alteration, to reduce the sulphur maximum.

Sir E. Beckett said he did not think it necessary to argue that point at present.

(To be continued.)

Ashbourne Gas Company and the Local Board.—At the meeting of the Ashbourne Local Board on the 11th inst., the clerk reported that, as directed at the previous meeting, he had written to the gas company, inquiring upon what terms they would sell their property to the board, and he had received the following reply:—"Ashbourne, June 7, 1877. Dear Sir,—In reply to your letter relative to the purchase of the gas-works by the local board, I am requested by the directors of the gas company to inform you that they have not the slightest intention of entering into any negotiations as to the transfer of their property.—(Signed) Edwin Bradley." The clerk explained that the board had no compulsory power of purchase, and that in case of a treaty being entered into, the sanction of the Local Government Board, and the assent of three-fourths in number and value of the shareholders present, or represented at a special meeting, would be necessary.

BRITISH ASSOCIATION OF GAS MANAGERS.

The Fourteenth Annual General Meeting of the Members of this Association was held on Tuesday, the 12th, and Wednesday, the 13th inst., at the Lecture Theatre of the Bristol Museum, Queen's Road, Bristol—Robert Paulson Spice, Esq., Memb. Inst. C.E., the President, occupying the chair.

Tuesday, June 12.

The President took the chair at ten o'clock this morning.

The minutes of the last general meeting, and the financial statement for the past year, having been previously printed and circulated amongst the members, were taken as read, and, on the motion of the President, were approved.

New Members.

The President stated that three gentlemen had applied for admission to the Association as extra-ordinary members. The rule on this point hitherto had been that, in addition to the usual annual subscription, extra-ordinary members should pay an admission fee of £5. It appeared to the committee, however, that in reference to future elections, including those which might take place on the present occasion, the annual subscription should be two guineas. The matter had been well considered, and the change proposed was thought by the committee to be desirable. He moved a resolution to that effect.

Mr. Magnus Ohren suggested that it would not be a proper course to alter a rule without due notice.

The President admitted that it would not, unless there was a general agreement in the meeting.

Mr. Warner said the gentlemen whose names were to be proposed on this occasion had applied for extra-ordinary membership on the conditions laid down in the existing rules, and he thought they should be admitted on the usual terms.

The President said the proposition might be considered as withdrawn at present, and a motion to give effect to the change he had intimated could be subsequently made.

The list of applications for ordinary and extra-ordinary membership, with the customary introductions and recommendations, was then read. The names are as follows:—

ORDINARY MEMBERS.

Ayris, J.	Norwich.
Barratt, S.	Gaythorne.
Bickford, J. M.	Carshalton.
Blott, E. B.	Richmond, Surrey.
Bower, T.	Lytham.
Brace, T.	Monmouth.
Bridge, W.	Cleckheaton.
Burgess, F.	Huddersfield.
Carr, J.	Todmorden.
Cotton, E.	Uxbridge.
Daniel, A. V.	Portishead.
Davison, W.	Crewe.
Dawes, S.	Clevedon.
Donaldson, G.	London.
Dougall, J.	Aberystwith.
Evans, T.	St. Mary Church.
Fetté, W. E.	Boston, U.S.A.
Freeman, H. S.	Wandsworth.
Gil, Claudio	Barcelona.
Green, R. A.	Carrickfergus.
Hammond, W.	Bognor.
Hammond, W.	Hampton.
Harper, H.	London.
Hastings, C. W.	London.
Henry, T.	Ebbw Vale.
Hudson, G.	Santiago.
Ker, A. P.	Birmingham.
Lane, G.	Aylesbury.
Leach, W. T.	Ventnor.
Littlewood, W.	Old Trafford.
M'Minn, F. J.	Fulham.
Mearns, J.	Banbridge.
Monnier, D.	Paris.
Moore, T.	Macclesfield.
Murray, M.	Bungay.
Oldfield, F. W.	Hull.
Redman, J.	Haworth.
Roberts, W. H.	Newton Abbott.
Sidle, R. J.	Hythe.
Stevenson, S. E.	Bournemouth.
Stiven, D.	St. Thomas, D.W.I.
Tait, W.	Portadown.
Walker, T.	Wrexham.
Webb, T.	Egham.
White, C.	Blaenavon.
Whyte, P.	Cardiff.

EXTRA-ORDINARY MEMBERS.

Calvert, J	Pontypridd.
Corbett, W.	Stourbridge.
Dempster, J.	Elland.
Dempster, R., jun.	Elland.
Hallsworth, S.	Armley.
Lockwood, T.	Stalybridge.
Wright, J.	Birmingham.
Wrigley, E. G.	Ashton-under-Lyne.

The above names having been submitted to the vote, it was resolved—"That the gentlemen whose names have been read be elected members of the Association."

The President then delivered the following

INAUGURAL ADDRESS.

Gentlemen,—I thank you sincerely and heartily for the honour you conferred upon me at your last annual meeting in the Metropolis, by electing me to occupy the presidential chair on the occasion of your coming this year to this ancient and important seat of commercial and manufacturing industry, to discuss those objects which claim our special attention as a scientific institution.

Advance in the Science and Practice of Gas Lighting.

In the year which has passed since we last met, there has been no flagging in the exertions which the active spirits among our members have of late years been accustomed to make in the constant pursuit of improved methods of gas manufacture; the objects at all times kept in view being, the reduction of cost, and the improvement of the quality, of the manufactured article, the scientific and the practical being thus directed to secure the best possible commercial results.

It does not always happen that these exertions are estimated at their full value by the general public, or by those who, in large towns and cities, are entrusted with the direction of public affairs; but that does not furnish

a sufficient reason for any relaxation of our efforts. It is our duty to be "instant in season and out of season," and, sooner or later, devotion to duty will be crowned with success.

The nature of the case is such, that a gas company occupy of necessity a position which, of all others, is calculated to beget in men's minds, suspicion and distrust. The supply of gas to a town or city being unavoidably a monopoly, any one requiring a supply, and having at any time a grievance, either fancied or real, against the company, cannot obtain relief by going to a shop over the way, or round the corner, and this too frequently gives rise to a feeling of antagonism which is difficult to remove, and has often resulted in furnishing employment to unscrupulous agitators, ready to promise *anything*, but competent to do *nothing*, but mischief.

The true remedy for this state of things lies mainly with yourselves, and I beg you will bear with me, while I endeavour to point out the course to be steered, to avoid exciting the public mind prejudicially, and secure that spirit of satisfaction and goodwill which contributes, where it exists, so largely to the prosperity of gas companies.

The Education of a Gas Manager.

The first step in this direction is for a manager to obtain a critically accurate knowledge of his art; I say art, advisedly and intentionally, for gas manufacture has really become an art, whereas it was formerly, and long within my own recollection, merely a rough-and-ready, and too often slovenly conducted, business. As a rule, all that was thought requisite, not very many years since, was to charge a retort with coal, keep up such a heat as would suffice to drive out all the gas in six hours or so, and then draw the resulting coke, the gas having been driven through an apology for a condenser, and so much lime as would prevent its blackening test-paper or a bit of silver, and sent into the gasholder, measured or unmeasured. As to any accurate knowledge of exact results, it was out of the question, not dreamed of in the philosophy of the gas managers of those easy-going times.

But a change has come o'er the spirit of the dream. The times are altered, men's wits have been sharpened, the voice of popular opinion has been heard and felt; what may be called gas literature has become widely spread; every session of Parliament has produced important additions to the vast amount of evidence placed on record as to what can be, and is, done in cheapening and improving the supply of artificial light; and thus is made clear the fact, that the gas manager of to-day must, if he is to hold his own, be an intelligent and painstaking man, well informed on all matters relating in any degree to the one subject, above all others, claiming his attention in a business point of view—namely, Light.

The subject itself is vast, and should be regarded comprehensively; and, although it may appear to be an extreme view, I cannot shrink from the expression of my opinion, that a gas manager should aspire to a scientific knowledge of the material structure of the globe, its place and its path in the universe, and attain to such a degree of familiarity with the sciences of chemistry, geology, and astronomy, as may enable him to bring to the practical and every-day labours of his life, the aid of those great principles which are involved in, and underlie, the solution of the problems which naturally arise, and require his skill in the determination of the right direction to be given in his dealings with the various forces of nature, intimately connected, as they undoubtedly are, with his common avocations, demanding the economical adaptation of the means to the end to be accomplished.

And these being the primary objects of his professional life, I would suggest that he would do well to have on his book-shelves Kingsley's "Town Geology," an elementary and popular work, treating of the soil of the field, the pebbles in the street, the stones in the wall, the coal in the fire, the lime in the mortar, and the slates on the roof; the works of Hugh Miller, entitled "My Schools and Schoolmasters," "The Testimony of the Rocks," and the "Old Red Sandstone;" Faraday's popular lectures "On the Various Forces of Nature," and the "Chemical History of a Candle;" "Notes of a Course of Nine Lectures on Light," delivered at the Royal Institution in 1869; and "Six Lectures on Light," delivered in America, in 1872-73, by Tyndall; and Herschel's "Outlines of Astronomy."

These several works contain almost inexhaustible and measureless mines of intellectual wealth, calculated to raise the conceptions, expand the intellect, and enlarge the resources of the gas manager, place him above the common level of his fellow-townsmen, and make his power felt by them, to a degree, and in a way, in which it could not otherwise be, quite as much to their advantage as his; and thus it would, in his own experience, prove the truth of Lord Bacon's aphorism, that "knowledge is power," always assuming that the knowledge is accompanied by the twin virtues, discretion and courtesy.

The chemist, the geologist, and the astronomer, each furnishes all-important aids to the gas manufacturer and manager, enabling him to trace effects to causes, make the best use of materials, direct his choice in their selection, and produce the best attainable results; unfolding the treasures of the material world which we inhabit, throwing light upon its progress towards what it now is, from what it once was, many millions of years ago, before the dry land appeared, and before the command went forth from the Great Architect of the Universe, "Let there be light."

The astronomer, opening to our wondrous gaze not only the position and courses of those planets, which, like our earth, perform, each in its own appointed time, the circuit of the central luminary which gives us light and heat by day, but teach us that outside our planetary system, there are countless myriads of worlds in the infinite space which we call the heavens; those which we can see, but whose distance we cannot measure, and which we call fixed stars, being, in all probability, suns and centres of life and light to systems of worlds, the light from which has not yet reached us, although travelling at the rate of 186,000 miles a second. All such knowledge must tend to furnish our minds with food for reflection, and inspire us with thoughts, concerning not only the finite, but the infinite, while we are dealing with created matter, and disinterring from the bowels of the earth, those carboniferous treasures which represent the buried vegetation of a period so remote, that the geologist can only estimate, but entirely fail to measure or determine, its age.

The Dissemination of Information amongst Gas Consumers.

The next desirable state of things to the possession of an extensive and accurate acquaintance with scientific knowledge, is the acquisition of a faculty for communicating and spreading that knowledge among one's fellow-men in our individual spheres. The peculiar demand of the times is, as Hugh Miller states in his "Testimony of the Rocks," that "what a man knows of science and art, he should freely communicate to his neighbours;" and the faculty of doing this may be acquired by practice, if it be not an inherent power.

In regard to this principle of action, we have in our own Association many pleasing and encouraging examples, the evidences of which I am proud to point to, in the many valuable papers which have been contributed, from time to time, and which are already enrolled in the records of our Transactions; and this list, I am happy to find, will receive important additions, at this our fourteenth annual meeting. It has been customary to refer to these papers from the chair, at the commencement of the meeting; but as I do not see the necessity for such a notice, inasmuch as each member has been furnished with a list of them, I shall so far depart from the custom, by honouring it in the breach, instead of the observance, and merely say, that I feel grateful to each of those gentlemen who have prepared a paper, which is, in fact, in each instance, evidence of devotion to the interests of the Association, proof of which I hope will never be wanting.

But, over and above all that has thus been done among ourselves, it is pleasing to see the instances, of very praiseworthy efforts made in this direction, by one or other of our members, in their own localities. To my mind, it is a refreshing sight to see a gas manager occupy the platform in the Lecture Hall, or Assembly Room, of his own town, as a lecturer on the recondite mysteries of light, and heat, and fuel, gas-burners, and gas-cooking, and the endless variety of matters connected with coal and its formation, character, and uses, its distillation and products, the tar and its dyes, the ammoniacal liquor and its salts. And while desiring, above all things, to avoid being invidious, I cannot refrain from mentioning, as cases in point, the names of Mr. Wood, of Hastings, whose lectures I have read with pleasure and profit; Mr. Macrae, of Dundee, and Mr. West, of Maidstone, whose recent appearances as lecturers in their own towns, explaining in a forcible way to their fellow-townsmen, without telling them so in so many words, what fools people are to use burners which will not allow the light-giving matter which the gas contains, to be made available for its purpose, and who, while grumbling at the price of gas, voluntarily or in ignorance, pay twice as much for their light as they need do, by wasting one-half of what they buy. And lastly, as the most recent instance of the kind, the brilliant example set by the South Shields Gas Company, in getting up, at no small cost, such an exhibition of gas cooking and heating apparatus, as has never before been witnessed or attempted, and which I attended as your representative, and gave to it the stamp of your approbation, in my official capacity, feeling certain of your approval. This important and practical exhibition was conceived by our excellent friend, Warner, who was most ably, and with far-seeing wisdom, seconded by the chairman and directors of his company; and we may well hope the good example will be followed by other companies, for the information thus spread cannot but bear good fruit.

Recent Gas Legislation.

And now let us direct our attention to recent gas legislation. In the last session, Parliament, for the first time, granted a corporation compulsory powers for the purchase of a statutory undertaking, the case being that of the Stockton and Middlesbrough Water Company, the terms fixed by the committee of the House of Commons being, 25 years purchase of the statutory dividend, with the usual addition for the sale being compulsory, and in addition thereto, the prospective improved value of the undertaking; the total sum to be paid to the company for the forced surrender of their property, and their interest in it, having to be determined by arbitration, which has not yet been done.

In the present session, compulsory powers have been sought to be obtained by local authorities, for the purchase of both gas and water undertakings in vain, the applications having been refused in each instance; but we have had to witness a strange and arbitrary innovation upon long-established usage, in the shape of a new "Standing Order," forced upon all companies applying for the first time for special Acts, and upon companies having statutory authority applying for further powers for raising additional capital—disturbing the accustomed course of parliamentary practice after the session had commenced, at the instance it is said of an under-secretary of a Government department; thus affording an instance of the inconvenience of that centralization, which threatens an injurious amount of interference with, that private enterprise which has raised this countryto its proud pre-eminence among the nations; and this demands more than a passing remark.

The new "Standing Order" repeals, in fact, a provision contained in the Companies Act of 1863, for the allotment of new shares in the additional capital of a company, *pro ratâ*, among the existing shareholders, and compels the sale of such shares by public auction; the premiums (if any) realized by such sales being applied as capital bearing no dividend. And as a set-off to the deprivation of the privilege of allotment, hitherto enjoyed by shareholders, except in special cases, a standard price of gas is to be fixed, in lieu of a maximum price as hitherto; and a sliding scale is applied, by which the dividends may rise or fall, above or below, the prescribed rates of 10 or 7 per cent., in proportion as the price charged for gas is below or above the standard price fixed by the Act; and thus it may happen that if gas can be, and is, sold at, say, 4d. per 1000 feet below the standard price, the dividend may be 11 per cent. instead of 10, or 8 per cent. instead of 7; the rule, as now established, being, that for every penny charged below the standard price, 5s. per cent. may be added to the dividend, and contrariwise, for each penny charged in excess of the standard, the dividend must be 5s. per cent. less than the prescribed rate.

In the present session the companies promoting Bills, whether opposed or unopposed, have had no cause of complaint in regard to the application of this new Standing Order, a fair margin having been allowed, in fixing the standard price, upon which, indeed, the whole question turns, and if those who have obtained liberal terms exercise their newly acquired powers with a wise discretion, the results of the application of the new theory may prove to be generally beneficial to the companies and consumers alike.

It is important, however, to bear in mind, and the fact cannot be too forcibly impressed upon the directors and managers of gas companies, that the main cause of all the modern warfare, between local authorities and themselves, has been the unquestioned prosperity of our special branch of industry, and that this of itself has excited, in some cases, the cupidity, and in others, the suspicions, of the governing bodies of towns and cities; illustrating again the truth of the proverb, "Where the carcase is, there will the eagles be gathered together."

The State of Commerce and the Relations of Capital and Labour.

But while gas companies have been thriving, commerce generally has been languishing; the high tide of prosperity, which, for several years past, has enabled Chancellors of the Exchequer to lighten taxation, seems to have been seriously checked, if indeed it be not turned, and on the ebb. The great demand for our national staples, coal and iron, has slackened very seriously, and a time of general depression appears to be imminent.

It is painful, under these circumstances, to witness the infatuated struggles going on here and there between employers and employed, the one urging the necessity for a reduction in the rate of wages, and the other demanding a rise, with a shortening of the hours of labour. The dispute on these points, between masters and men on the Clyde, has brought about the serious result of the enforced idleness of about 30,000 men in that district, the cessation of the means of earning sustenance for their families, and paralyzing the trade of the district. The same cause, and the like effects, have also led to serious derangement in the colliery districts of Northumberland, where one declared object of the men was, to diminish the output of coals, with the view of forcing up the price; some 12,000 hands are said to be idle there, instead of being busy, as they might be, earning, by honest labour, fair wages for the maintenance and comfort of their families.

We are thus painfully reminded of the time when the shipbuilding

trade was, by such suicidal folly, driven from the Thames, and the miserable spectacle was seen, of empty shipyards and workshops, with all the attendant miseries, of starving families, and deserted homes. And we can but ask—Is all such experience useless? Will men still go on under the influence and control of trade unionism dictation—ceasing to judge for themselves, surrendering private judgment, and act as they may be ordered by those who rule the trade union societies, instead of disposing of their labour and skill in the open market, on terms satisfactory to themselves, and those who obtain the orders for ships, for willing hands to build, and machinery for skilled artizans to produce?

It does not appear to occur to those multitudes of working men who are under such guidance, that, just as an important branch of industry may be, and often has been, driven by "strikes" from one locality to another, to the ruin of many, so it may be driven from this country, never to come back; but this is the issue now at stake on the Clyde. Those who want to buy ships cannot get supplied on that river, because the masters have been compelled to close their yards, so the buyers must seek what they want in another market; and thus the trade may be driven from the country, and possibly return no more, the change involving a national disaster, through the operation of what may be truly called the *curse of this country*—namely, trade unionism.

These, however, are not the only considerations connected with the labour market demanding our attention, and by which the interests of gas companies may be seriously affected. The fact is patent to the world, that the purchasing power of money is less than it was a few years since. The logical consequence of this is, that more money must be given for whatever we have to buy, whether it be labour or materials, or manufactured articles; and in this way the value of a gas undertaking, like any other real property, is enhanced, and in all recent sales of gas property, by companies to corporations, this has been felt, even where it has, perhaps, not been seen or understood, the general increase in the value of such property being practically equal to the diminished value of gold, which has been estimated by competent authorities at about 20 per cent., the increased production of gold having had this effect.

Purification of Gas from Sulphur Compounds.

Within the last few days, a decision has been given by a committee of the House of Commons, on "the sulphur question," which has recently been again debated, and voluminous evidence given thereon, before that tribunal, two Bills having been brought before it, one by the Crystal Palace District Gas Company, and the other by The Gaslight and Coke Company, the object of each company being, to obtain relief, from the expense and inconvenience, of complying with the requirement to eliminate, what are called the sulphur compounds from the gas, to such a degree, that not more than 20 grains shall be found in 100 feet, and both Bills have been rejected, thus leaving the companies as they were.

The question has been, whether the public suffer more, from the nuisance arising from the use of lime, or from the sulphur compounds, when lime is not used as a purifying material.

When oxide of iron alone is used as a purifying agent, the only sulphur compound removed is H_2S (sulphuretted hydrogen), a most offensive smelling and injurious gas; but every one of you well knows that there are other sulphur-holding compounds which are present in gas, the principal, and the only one, the existence of which has been completely demonstrated, is bisulphide of carbon, CS_2. It is conjectured, and we have very strong reason to believe, that sulphuretted hydrocarbons are also present in coal gas. Now, the removal of the CS_2, or, at all events, a large proportion of that which exists in ordinary coal gas, is a comparatively easy matter. But, so far as we know at present, there are no chemical means of taking out the sulphuretted hydrocarbons.

CS_2 is what chemists call a weak acid, and it has the power of combining, with other sulphuretted compounds, such, for example, as sulphides of calcium and ammonium. Now, when it is desired to remove as completely as possible this CS_2, the gas manufacturer has, as a preliminary step, to get a purifier charged with sulphide of calcium. Then, the gas being carefully purified from carbonic acid, the CS_2 it contains, enters into combination with the sulphide of calcium, and is detained. This process is arrived at with the greatest success, at the Bow Common and Beckton works of the Chartered Company.

The same thing may be done, to an almost equal extent, by the use of strongly sulphuretted ammoniacal liquor, care being again taken to remove the carbonic acid in an early stage of the process, as practised successfully at the South Metropolitan works by Mr. George Livesey.

The objection recently raised before Parliament is, that it inevitably occasions a nuisance in the neighbourhood of the works, by the removal of the lime. The purification of gas in close vessels involves a nuisance in a much less degree, and it is highly desirable, that the process of purification should be so conducted, as at all times to avoid, if possible, giving cause of offence to those who are fastidious, respecting perfumery; but the great object of a gas manager should be, so to distil his coal, as to create, or set free, and send forward in his gas, as small a quantity of these obnoxious products as may be possible, or practicable, and here, in my opinion, there is room for improvement in our common practice.

Formerly, say 25 years ago, when iron retorts were in common use, the practice was to distil coals at much lower heats than have been common since that period, with the use of clay retorts.

I need not trouble you with any remarks or reasons to show how, and why, the use of clay retorts involves the necessity of what may be called the high-heat system, because, as practical men, you can hardly fail to know that the two—that is, clay retorts and high heats—are inseparable; but I may take this opportunity of putting forward a theory which I believe will be proved to be perfectly sound and reliable; hence I give it as my well-considered opinion, that our common practice of charging clay retorts on the scoop system, is the source and main cause of all the difficulty involved in the "sulphur compound" agitation.

The coal being laid in a thick mass, the outside is over-cooked before the interior has been sufficiently acted on by the heat of the oven, and this is productive of mischief, not known in the days of iron retorts, by the expulsion of the obnoxious compounds which formerly were left in the coke; hence I state it, as my belief, that the way to overcome the difficulty of not being able, by any known purifying process, to take them out of the gas, is by not, in the first instance, putting them in. And I have been led to this conclusion, by observing that this is done, in common practice, by West's system of charging, the coal being deposited in a thin stratum, and worked off in four hours instead of six, the heats and the quantity being the same as, on the scoop system, would require six hours.

The Electric Candle.

As regards the electric light, the public have recently been led to expect great things, and cheap things, from a Russian inventor, M. Paul Jablochkoff, who has devised a candle which is to give the light of at least 100 other candles, and cost less than gas, thus casting our poor gas-burners, the pride of our hearts, into the shade, in more ways than one. And, full of hope that it might be my happy lot to be able to communicate to you, some pleasing information respecting this wonderful invention, I applied, in my official capacity as your President, for permission to attend a private exhibition of it, and an invitation was very courteously sent me by the agent of the proprietors of the patent, Mr. R. Applegarth.

But, unfortunately, what was intended did not come to pass. Some 200 gentlemen, interested in scientific matters, attended at the appointed time and place—namely, at nine o'clock in the evening of the 5th inst., at the West India Docks, and after waiting till half-past ten, were obliged to leave to catch the last train to the City, without seeing that for which they had put themselves to no small inconvenience. The cause, as we were informed, was the break-down of a steam-engine, without which, the electric generator could not be worked.

Assuming, however, that the thing had been a success, its superiority over other electrical lights would have been but a matter of degree. The inconvenience of a light too powerful for the human eye would still remain, and the light of 100 candles from one burner would require to be reduced, by shading, to about one-fifth of its power, to render it admissible for the ordinary purposes of life, thus reducing its value, while the cost of production would remain the same. It is thus obvious, that if the light of 100 candles be produced, and 20 only are available, the 80 are obscured and wasted. And there would also remain the fatal objection, of its not being diffusible, besides all which, its cost must be such, as to put out of the question its becoming a rival to coal gas, until some means be devised for *collecting* electricity, instead of having to employ steam power for its *generation*.

Nevertheless, such lights are undoubtedly highly desirable and valuable for certain purposes, such as lighthouses, large spaces, submarine work, and a variety of other possible uses, and we should hail with pleasure the improvement of the electric light, as we should any other addition to the comfort, profit, and advantage of the human family. But I think I may safely say, that there is not the slightest probability of property invested in gas undertakings being affected in value by any kind of electric light; and that the fear of any such result can only be seriously entertained by the ignorant.

I cannot, however, leave the electric light without mentioning the fact, that Dr. Siemens has successfully grappled with the difficulty previously felt in connexion with the carbon points being kept at the proper distance apart, and which, till recently, was effected only by a clockwork arrangement.

I had occasion, a short time since, to visit the extensive iron-works of Messrs. Head, Wrightson, and Co., at Stockton-on-Tees, and saw there a lamp, invented by Dr. Siemens, by which the carbon points were kept in their proper position automatically, and was informed by a member of the firm that they had found it very useful in the construction of an iron girder bridge, 250 feet long, the girders being 26 feet deep, upon their works, whereas without such an appliance they could not have kept their men at work upon the structure by night as well as by day last winter.

Deaths of Members during the Past Year.*

We have to regret the loss by death, since we last met, of Joseph Braddock, of Fairfield, near Manchester; John Chester, of Swinton; C. B. Darwin, of Ulverstone; J. T. B. Porter, of Lincoln; and William Fraser, of Inverkeithing.

I had not the pleasure of a personal acquaintance with the first four gentlemen in this mournful list of five, whose loss we have to lament, but I had the happiness of knowing our departed friend Fraser, of Inverkeithing, whom to know was a pleasure and privilege, and it was with a feeling of profound regret that I heard of his removal from among us. We can all well remember his familiar countenance, marked by intelligence and inspired by good will, his manly, common-sense, and kind-hearted tone of mind, generous sentiments involuntarily escaping from his tongue; and of him it may truly be said that "The law of kindness was on his lips."

Position of the Association.

Five members have withdrawn, from various causes, leaving 594 on our list this morning; we have now added 55, making our number now 649.

I beg now to invite your attention to the fact, that the expenditure of the Association has somewhat exceeded the income for the past two years, which I am confident has only to be mentioned to be corrected, and the balance made to appear on the right side of the account; simply by some of those of our number who have been in the habit of subscribing half a guinea a year instead of a guinea—from a feeling of delicacy, and the avoidance of anything like ostentation towards those who can only afford half a guinea—just doubling their annual subscriptions.

And in reference to the expense of our members leaving their homes to attend the annual meetings, I venture to think it will not be out of place for me to refer to the excellent letter of our friend Hartley, which appeared in the Journal of Gas Lighting three weeks since, reminding those directors of companies who have not hitherto considered the matter, that the ofttimes valuable information picked up by their managers through attending these meetings, is an addition to their previous stock, which is available for the benefit of shareholders and consumers alike, and thus would fully justify the payment of such expenses out of the revenue account of the company, and it is my earnest hope that we shall not again hear of any managers having to attend the annual meetings at their own cost.

New Works in Progress.

It only remains for me to mention, as illustrating the progress which is being made in the designing and construction of vessels and apparatus required for the manufacture and storeage of gas, that a gasholder to contain 3,100,000 feet, to work in a brick tank—the largest in the world—has been designed by our friend Mr. Woodall, of London, for the Phœnix Gas Company, a description of which I hope we may, in due time, be furnished with, if, indeed, we may not have the pleasure of holding one of our annual meetings in the tank. The contract for this monster holder has been entrusted to Messrs. Cutler and Son, of Millwall, the construction of the tank having been undertaken by Messrs. John Aird and Sons, of London. Also the fact of a station-meter being in course of construction for the London Company, by the Gas-Meter Company, on what is called the Reliance principle, to pass 250,000 feet per hour; and another, by Mr. Sugg, for the Fulham station of The Gaslight and Coke Company, to pass 200,000 feet per hour.

And while on the subject of meters, it is pleasing to find that the inventive faculties of our members are directed towards the attainment of absolute perfection in registering the consumption of gas under varying circumstances as to speed, pressure, and water-level. The Reliance meter has been designed with this view, and Mr. Hunt, of Birmingham, has also come to the front with a new arrangement for producing the same result.

The Sunday Labour Question.

I am pleased to hear that the movement set on foot by Mr. Morton, to diminish Sunday labour in retort-houses, has been continued with growing success, the management of many works having been conducted with zealous regard to this object.

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* A letter from the President, which appears in our "Correspondence" columns, points out an omission in this record of deceased members.

ESTABLISHMENT OF A BENEVOLENT-FUND.

I cordially congratulate the Association upon the support accorded to the scheme for establishing the Benevolent-Fund, the principle having been adopted, and above £800 subscribed, the particulars of which will be reported to you by our secretary, when you will be asked to adopt the rules, which have already been circulated among the members.

And now, gentlemen, hoping I have not trespassed too much on your patience, I invite your attention to the business of the meeting.

PREMIUMS FOR PAPERS.

The PRESIDENT: Gentlemen, I have now to inform you what premiums have been awarded by the adjudicators, for papers read at the last annual meeting. Three of the four premiums only have been allotted. The first, of £10, was awarded to Mr. Richards, for his paper on "Retort-Settings;" the second, of £7, to Mr. Hunt, for his paper on "Washers or Scrubbers;" and the third, of £3, to Mr. Fison, for his paper on "A New Self-Regulating Exhausting Apparatus."

APPOINTMENT OF SCRUTINEERS.

Mr. A. LASS and Mr. F. W. HARTLEY, having volunteered their services, were elected scrutineers of the ballot papers for the election of officers and committee of the Association for the ensuing year.

READING OF PAPERS.

The reading of papers was then proceeded with. They are enumerated here in the order in which they were read, and we reserve their publication and our report of the discussions thereon, as usual, for succeeding numbers.

The first paper read was by

Mr. R. O. PATERSON, of Cheltenham, on "Experience of Körting-Cleland's Steam-Jet Gas-Exhauster, with Notes on its Adaptability and Economy."

Mr. R. W. BRETT, of Hertford, read a paper on "The Supply of Gas to Public Lamps."

Mr. PEARSON, on behalf of Mr. W. Sugg, who was unable to be present, read a paper on "Railway Carriage Lighting."

Mr. A. F. WILSON read a paper on "Lighting and Extinguishing Automatically."

In the evening, a lecture was delivered before the members by Mr. THOMAS CARGILL, C.E., B.A., T.C.D., President of the Society of Engineers, on "The Strains upon Girders, Trusses, and Braced Structures, and the Mode of Ascertaining and Calculating them."

WEDNESDAY, JUNE 13.

The PRESIDENT took the chair at ten o'clock this morning.

PROPOSED ALTERATION OF RULES.

The PRESIDENT: I think this may be an opportune time to consider whether the proposition I made yesterday as to the amount of annual subscription required from extra-ordinary members should be carried into effect. The committee think the subscription for that class of members should be fixed at two guineas, and now that no gentleman is before us for election, there is nothing personal in the way if you also think it desirable to make the change.

Mr. ELDRIDGE: The rule, as altered, would not apply to existing members of that class.

Some members appearing to think it better that notice should be given of a motion to be submitted to the next annual meeting on the subject,

The PRESIDENT said he saw no objection to that course. It could then be discussed under the notice now given, without appearing to reflect in any way upon the gentlemen proposed at that time for election.

Mr. HODGSON JONES, however, moved that the original proposition made by the President be adopted.

Mr. MORTON seconded the motion.

Mr. WILKINSON moved as an amendment that notice of the proposed alteration be given for consideration at the next meeting.

The amendment was seconded, but, on being put to a show of hands, was negatived.

The motion was carried by a considerable majority.

Mr. CARR, of Halifax, wished to propose another alteration. He had not been favoured with a copy of the rules, but at the present time, as he understood, the committee nominated all the officers of the Association, and he believed it had been already felt that it was not exactly a fair thing that they should be allowed, or, rather, according to the constitution, be compelled to choose their successors.

The SECRETARY said Mr. Carr was under a misapprehension in the statement he had made. He had no doubt received a copy of last year's proceedings, as all other members had, and appended to that report were the whole of the rules.

Mr. CARR apologized for the oversight; he had not noticed that the rules were attached to the report.

Mr. HODGSON JONES thought the ballotting papers used by this Association were the same as those employed by other societies of a similar kind, and every member had the opportunity of altering the list as he might desire.

The PRESIDENT said he was a member of several associations, and in all the rule was exactly the same as in this.

Mr. HARTLEY remarked that, as one of the acting scrutineers, he had had the opportunity of seeing to what an extent the members did exercise their judgment in selecting names for the various offices to be filled. As far as he knew, the practice prevailing in this Association was the same as in all others, and he was afraid that if any other arrangement were introduced, the scrutineers might be occupied for a week instead of a day.

The conversation upon this point then dropped, it being understood that it would be revived at a subsequent period of the proceedings.

The PRESIDENT: Now that we are upon the question of a proposed alteration of rules, I should like to call attention to rule No. 3, which says, "Ordinary members shall be either engineers, managers, or secretaries of gas-works." Now, in the early history of the Association, that rule was not rigidly adhered to, but lately it has been interpreted in strict accordance with its true meaning, and both last year and the year before cases came up, and applications for membership were made, which the committee could not entertain. Two similar cases have presented themselves this year, and, acting according to the strict interpretation of our regulations, we were obliged to decline them, although according to our judgments both gentlemen should be members of the Association. They are, however, neither "engineers," "managers," nor "secretaries." They are both gentlemen engaged with large gas companies as outdoor superintendents, having most important control over the administration of affairs. One is a gentleman in the City of London, a man with a large fund of information, and a great amount of practical knowledge, who would be without doubt a valuable acquisition to the Association. Now the way we propose to get over the difficulty is this—that there should be a discretionary power vested in the committee, and we, therefore, propose to add these words to the rule, "except in special cases in which the committee may deem it necessary that the rule should be relaxed."

A MEMBER said he thought there might be a discretionary power given to the committee, not to elect such a person, but to submit his name to the meeting.

Mr. C. WOODALL said instances had occurred in which practically what the President proposed had been done, and now it was sought to legalize the practice where its exercise seemed desirable.

Mr. FRITH, of Runcorn, moved that such an alteration be effected in the rule as would give the committee power to submit names to the general meeting of members for approval.

Mr. WARNER, of South Shields, thought, instead of making alterations here and there, it would be better to have a sub-committee to revise the constitution of the Association altogether. It was evident to him that some changes were required. He proposed a resolution to that effect.

Mr. SIMPSON, of Rugby, seconded the motion with much pleasure. He thought it would be found that according to the original rules, it was intended that not only engineers, managers, and secretaries were eligible for ordinary membership, but others who were interested in the manufacture of gas. His old friend, Mr. Broadhead, however, objected to this proposal, and wished it confined to gas managers only.

Mr. CARR thought the impression ought not to be entertained, that because a gentleman was an outdoor superintendent, *therefore* he could not be considered as a gas engineer.

Mr. BARRETT, of Grantham, said he remembered having a conversation with one of the founders of the Association, the late Mr. Adamson, who, in reference to this point, remarked that there were some men outside who were far more qualified for membership, and would prove of far more value to the Association, than mere secretaries of gas companies. He (Mr. Barrett) thought, if the rules were altered, it would be well to exclude secretaries pure and simple, who had no knowledge at all of the manufacture of gas.

Mr. BALL, of Wortley, said, if the question now was whether secretaries should belong to the Association, it would be better to discuss it in a committee of two or three members, as proposed by Mr. Warner, and not in the general meeting.

The PRESIDENT: In stating what the views of the committee are, I have not come forward with any "cut and dried" proposition. We simply feel somewhat of a difficulty, because the gentlemen who desire to become members do not answer the description in the rule, and we have no discretionary power in the matter. It was, therefore, left for me to mention the point. It is a question which should be looked at calmly, and need create no division of feeling amongst us as a body.

The motion was then submitted to a show of hands, and was declared to be carried.

The PRESIDENT: This discretionary power having been given to the committee, I have now to ask the secretary to read the propositions for membership which the committee recommend you to accept.

The SECRETARY read the names of Mr. J. Johnson, London, and Mr. Thomas C. Hersey, London, who were unanimously elected ordinary members of the Association.

READING OF PAPERS.

The reading of papers was then resumed.

Mr. C. WOODALL, of London, read a paper on "Some Experiments upon the Power and Fuel Expended in Exhausting Gas."

Mr. J. ELDRIDGE, of Richmond, read a paper on "Evidences of Economy in Carbonization by the Use of West's System."

Mr. W. J. WARNER, of South Shields, read a paper on "Periodical District Pressure Taking."

Mr. A. LASS, of London, read a paper on the question: "Is the Adoption of the Form of Accounts, as scheduled in the Gas-Works Clauses Act, 1871, by all Gas Companies and Corporations, desirable."

Mr. W. H. BENNETT, of London, read a paper on "Means of Extending the Use of Gas and Coke, and How their Consumption may be Increased."

PROPOSED ALTERATION OF RULES.

The PRESIDENT said he had now to ask for an expression of the opinion of the meeting on a proposal of the committee to alter the time for making up the annual accounts. Hitherto they had been made up to the 30th of April in each year, but the Finance Committee, in a report which they had made to the General Committee, strongly recommended that for the future the accounts should be made up to the 31st of December, and they stated several very good reasons for the proposed alteration, which the General Committee entirely endorsed.

On a motion made for the purpose, the alteration was unanimously agreed to.

Mr. G. ANDERSON, of London, thought it would be an improvement if the published list of subscriptions was arranged alphabetically, so that, without difficulty, members might find out whether their subscriptions were paid or not.

Mr. WARNER remarked that the several propositions for alterations which had been brought forward clearly indicated to his mind the desirableness of a revision of the rules. He would therefore move—"That a sub-committee be appointed, consisting of the President and six other members, to examine and revise, if necessary, the rules of the Association, and report thereon to the next annual meeting."

Mr. CARR seconded the motion, reiterating the observations which he made on the subject on the previous day about the inconsistency and anomaly of the committee nominating their own successors.

Mr. TALLENTIRE remarked that, of the names nominated in the committee's list, there were nine resident in the southern districts of England, and not one Scotch or Irish member.

The PRESIDENT said it seemed to him that the motion involved the appointment of two committees to do the work of one. The General Committee of the Association when elected, would be quite competent to undertake the revision if that were thought to be desirable, and it would be a reflection upon their judgment and impartiality if a second committee were appointed for the purpose. With regard to Mr. Carr's observations, he would only say that when the lists were sent out, members were at liberty to strike out any names and insert others, and, if they failed to do so, they ought not to blame a system of nomination which had been found to work well in other associations. He (the President) thought that there were practical difficulties in such a change as was proposed, which those who advocated it did not at present realize.

Mr. R. O. PATERSON did not see how the meeting could well take out of the hands of the General Committee the duty which clearly belonged to them, and he should move as an amendment that the selection of names be left in the hands of the committee, as before.

Mr. SYMS, of Rochester, seconded the amendment, which, on a show of hands, was declared carried by a large majority.

BENEVOLENT-FUND.

The SECRETARY was called upon by the President to report the progress of the Benevolent-Fund. He said: It will be remembered that at the last annual meeting the Benevolent-Fund was established, and the question was remitted to the General Committee to devise a scheme and set of rules for the government of that fund. A set of rules was prepared, and a copy sent to each member for review and criticism. These were then returned and corrected, and a second copy sent to each member, and he (the

secretary) had not received notice of a single dissentient from the rules as finally settled. The members now assembled were asked formally to adopt those rules. A list of the subscriptions had been sent out, but since then there had been considerable additions. The total amount of subscriptions and donations was now £338 8s. This sum had been contributed by 125 subscribers and 31 donors, and he proposed in the course of a few weeks to circulate a list of the contributors, with the amount subscribed or given attached.

On the motion of the PRESIDENT, it was then agreed to adopt the rules as printed, save and except that which related to the financial year, which, according to the resolution previously passed, was made to terminate on the 31st of December.

SUGGESTED EXTENSION OF THE ASSOCIATION.

Mr. TRAVERS, of Cork, said he was desirous of submitting to the meeting the feasibility of admitting water engineers as members of the Association. As the meeting was aware, there were several of the leading members of the Association at the present time who were both gas and water engineers, and he believed that if the limits were extended so as include water engineers, as such, as well as gas engineers, it would tend very much to increase the value of the institution. It might be thought by some that water questions would not possess sufficient interest for gas engineers to justify his proposition, but he did not share in that feeling himself; but, on the contrary, he felt sure that the admission of water engineers, as such, to membership would lead to considerable advantage.

The PRESIDENT said he quite agreed in what had fallen from Mr. Travers. It seemed to him a self-evident proposition that it must be for the advantage of the Association to admit these gentlemen. It had been his pleasure on the present occasion to introduce a gentleman as a member who was much more a water engineer than a gas engineer—he referred to Mr. Ayris—a gentleman second to none in his profession, and one who would do honour to the Association. If the meeting, therefore, would accept Mr. Travers's suggestion as a motion, he (the President) would be happy to second it.

Mr. IRONS and Mr. WARNER raised objections to the adoption of such a motion without notice.

Mr. MORTON said it was not because he objected to the introduction of these gentlemen into the Association that he should oppose the motion, but because alterations would be involved in the constitution of the Association, which ought not to be undertaken without due notice.

Mr. H. P. STEPHENSON said it involved not only an alteration in constitution, but in name also. He did not say whether, as an individual, he should object to the scheme or not, if it were properly before the meeting; but it did seem somewhat absurd to object to the introduction of gentlemen into the Association, because, though they might be superintendents of large gas-works, they were not "engineers," by which step the society would be largely extended, and yet, at the same time, propose to enlarge it by the introduction of a class of gentlemen who had no connexion with gas manufacture in any way whatever.

Mr. HEPWORTH, of Carlisle, moved, and Mr. MAGNUS OHREN seconded, that the matter be referred to the committee for consideration, so as to relieve the meeting from the necessity of accepting or rejecting the proposal of Mr. Travers at the present moment.

The amendment was agreed to.

MEMBERS IN ARREAR.

The SECRETARY read a list of the names of members whose subscriptions had fallen into arrear for two consecutive years, and who, under Rule 37, *ipso facto* cease to be members from the time.

TIME AND PLACE OF NEXT MEETING.

Mr. MORTON moved that the next annual general meeting be held in London on the second Tuesday in June, 1878.

Mr. GODDARD seconded the motion.

Mr. HELPS, of Bath, moved that the next general meeting be held in Paris.

Mr. MAGNUS OHREN said it was not a rule, but it was a custom for some time observed, that the alternate meeting of the Association should be held in the Metropolis. Next year, however, was the year of the Paris Exhibition, and no doubt many members would be glad of the opportunity of visiting France on that occasion. For his own part, he did not know why they should not go to both places—meet in London for the transaction of business, and make their annual excursion afterwards to Paris.

Mr. BALL seconded the proposition.

The PRESIDENT said he cordially concurred in Mr. Ohren's suggestion; it was a very sensible one, and, he thought, quite feasible. It would not do to attempt to hold the business meeting in Paris; it would not be consistent on many grounds; but a visit there afterwards could be very nicely arranged. The *Société Technique de l'Industrie du Gaz* corresponded almost entirely with the British Association, and he was sure would be pleased to welcome them. Having held their business meeting in London, there was no reason why the members should not make an excursion to Paris instead of down the river to "spend a happy day" at Rosherville. He had just had a telegram put into his hands from Mr. Sugg, who was now in France, in which he said, "By all means come to Paris; you will see some new works at Clichy, and M. Ellissen and I will act as interpreters."

The motion for holding the next meeting in London and having an excursion to Paris was put and carried unanimously.

ELECTION OF HONORARY MEMBERS.

On the motion of the PRESIDENT, seconded by Mr. GODDARD, it was unanimously resolved—"That Mr. James Glaisher, F.R.S., and Mr. W. Richardson be and are hereby elected honorary members of the Association."

ELECTION OF COMMITTEE AND OFFICERS.

The SECRETARY read the report of the scrutineers as to the result of their examination of the ballot papers, from which it appeared that the following gentlemen had been elected for the ensuing year:—

President.—Mr. Corbet Woodall.
Vice-Presidents.—Mr. John Douglas, Mr. Charles Hunt, and Mr. W. J. Warner.
Treasurer.—Mr. Henry Newall.
Secretary.—Mr. W. H. Bennett.
Committee (new members to replace those going off by rotation).—Mr. R. Harris, Mr. J. Hepworth, Mr. A. H. Wood.
Finance Committee.—Mr. G. Livesey, Mr. G. W. Stevenson, Mr. J. Eldridge.
Auditors.—Mr. A. Hersee and Mr. A. Lass.
Benevolent-Fund Committee.—Mr. R. P. Spice, Mr. W. J. Warner, Mr. E. Goddard, Mr. J. Hepworth, Mr. J. R. Frith, and Mr. J. Storer.

Mr. C. WOODALL said: Gentlemen, I feel that it would be impossible for me to let the meeting separate without acknowledging my sense of the honour you have conferred upon me by electing me to the office of President. I can only assureyou that, so far as it lies in my power, I will do my utmost to maintain, during the year of my office, the usefulness and credit of the Association to which I am very proud to belong.

VOTES OF THANKS.

Mr. CUTLER: I rise to propose a resolution, which I am sure will be received with much pleasure, and that is a vote of thanks to the writers of the papers on the present occasion. It would be invidious for me to mention any one in particular, for they were all good, and it has been a great satisfaction to listen to them.

The motion was put, and carried unanimously.

Mr. HARTLEY: It is my pleasure to move a vote of thanks to the committee. I think they have shown themselves thoroughly deserving of our approbation for the manner in which they have conducted the affairs of the Association in the past year.

Mr. IRONS seconded the motion, which was put and carried.

On the motion of Mr. STORER, seconded by Mr. FRITH, thanks were then voted to the treasurer.

Mr. LONGWORTH moved, and Mr. STOUT seconded, a vote of thanks to the scrutineers.

The PRESIDENT remarked that the scrutineers were well deserving of this compliment, as their labours involved a large amount of self-denial and sacrifice.

The motion was put and carried unanimously.

Mr. GODDARD: Now, gentlemen, I have to propose a motion which is not of a formal character, but is one in which I am sure you will most cordially concur. The very valuable Inaugural Address of the President, in which he departed from the usual course adopted by his predecessors, in directing our minds to the pursuit of more enlarged scientific requirements, the very admirable administrative skill which he has shown in conducting the business of this Association, the instructive manner in which he has epitomized the papers and discussions during these meetings, and the natural courtesy which he always manifests, have entitled him, I am sure you will feel, to our very warmest thanks. It is, therefore, with much satisfaction I propose—"That the best thanks of the Association be given to Mr. Spice for the great ability with which he has presided over the meetings of this Association."

Mr. MAGNUS OHREN seconded the motion, which was put, and carried unanimously, and, amidst loud cheers,

The PRESIDENT, who was fairly overcome by the heartiness with which the vote was responded to, said: Gentlemen, I cannot give expression to my feelings in words; I can only say I thank you for your kindness. (After a pause, the President again rose and said:) There is one pleasing duty I have yet to perform, and that is to ask you to give a vote of thanks to Mr. Bennett, our secretary, for the manner in which he has conducted the business of the Association, not only to-day and yesterday, but during the whole year since we last met together. We who work with him know how to appreciate his valuable services, and the more we see of him the more we value the help he is able to render us. Let us give him a hearty vote, and express the hope that he may long be spared to fill an office the duties of which he so well discharges.

The motion was put, and cordially adopted.

The SECRETARY: Allow me to acknowledge the kind expressions which have fallen from our worthy President, and to thank the meeting for the vote of thanks just given to me.

On the motion of Mr. CARR, thanks were voted to the auditors for their services.

The PRESIDENT, in closing the proceedings said: There is one pleasing bit of news I am able to give before we separate, and I especially mention it, because in my opening address I referred to the subject. I am happy to state that there is an end to the Northumberland dispute—a dispute which threatened to issue in disastrous consequences.

The annual dinner of the members took place in the evening at the Grand Hotel, Broad Street, and on the following day an excursion was made to Chepstow and the ruins of Tintern Abbey.

Register of New Patents.

APPLICATIONS FOR LETTERS PATENT.

2128.—BURT, P., Glasgow, "Improvements in the arrangement or construction of double-acting steam-pumps." June 1, 1877.

2132.—POPE, J., Folkestone, Kent, "Constructing a receiver for conveying and for adjusting the flow of water to the pans of water-closets." June 1, 1877.

2135.—PARKES, J., Birmingham, "Certain improvements in taps or cocks for steam, water, and other similar purposes." June 1, 1877.

2177.—CROSSLEY, F. W., and CROSSLEY, W. J., Manchester, "Improvements in gas motor engines." Partly a communication. June 4, 1877.

2231.—BAGSHAW, J. and W., Batley, York, "An improved equilibrium valve for water and other fluids." June 8, 1877.

2238.—NEWMAN, J., Litchurch, Derby, "Improvements in apparatus for transmitting gas from the retorts to the hydraulic main." (Complete specification.) June 8, 1877.

2249.—STRONG, M. H., New York, U.S.A., "Improvements in the manufacture of gas for illuminating and other purposes." June 9, 1877.

2269.—EELLS, A. F., and LOUD, S. C., Boston, U.S.A., "Improvements in pumps." (Complete specification.) June 11, 1877.

2281.—PITT, S., Sutton, Surrey, "Improvements in machines for charging and discharging gas or other similar retorts, and for measuring the coal which is to be deposited in such retorts, and in arrangements for operating these contrivances." A communication. (Complete specification.) June 12, 1877.

2291.—LAKE, W. R., Southampton Buildings, London, "Improvements in apparatus to be arranged in connexion with gas pipes or burners for opening and closing the cocks thereof by electro-magnetism." A communication. June 12, 1877.

2295.—HAMILTON, F. A., Southwark, and HAMILTON, F., Hackney, London, "Improvements in reflectors, diffusors, and concentrators of light, and motions or actions for moving or regulating the whole or part of the same." June 13, 1877.

2330.—PARSONS, Hon. R. C., Connaught Place, London, "Improvements in pumps." June 14, 1877.

2334.—ROBSON, J., North Shields, Northumberland, "Improvements in engines operated by the combustion of gas or vapour." June 14, 1877.

PATENTS WHICH HAVE BECOME VOID

BY REASON OF THE NON-PAYMENT OF THE ADDITIONAL STAMP DUTY OF £50 BEFORE THE EXPIRATION OF THE THIRD YEAR.

1929.—SCHANZER, L. I. L., "A new or improved instrument or apparatus for drilling and tapping or screwing mains under pressure, and attaching pipes, cocks, or connexions thereto." June 3, 1874.

1973.—MATTHEWS, H., "Improvements in apparatus for preventing the return or back flow of gas, water, and other fluids in sewers, drains, and other similar situations." June 6, 1874.

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